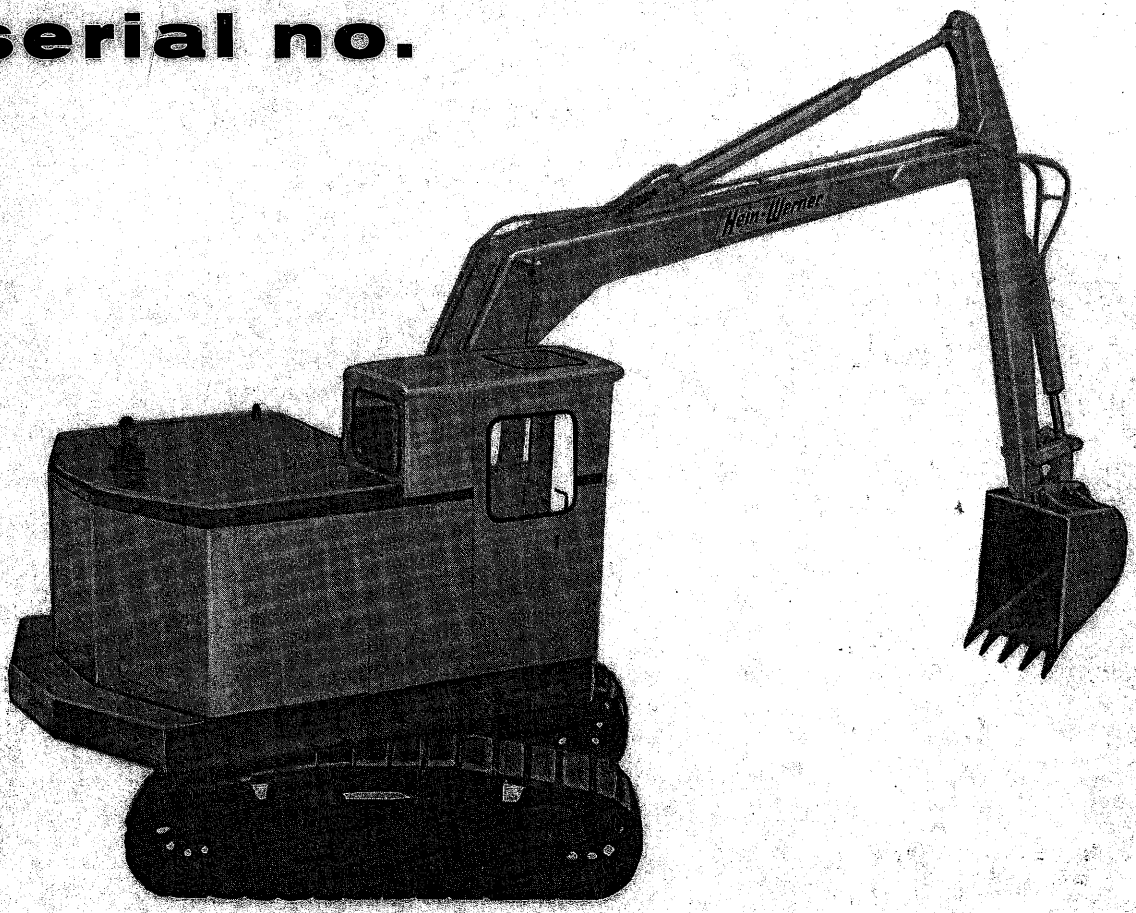
BULLETIN CED-21

Hein-Werner

HYDRAULIC EXCAVATORS

service manual
model
serial no.



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Hein-Werner
CORPORATION
CONSTRUCTION EQUIPMENT DIVISION
WAUKESHA, WISCONSIN 53187

Hein-Werner

service manual

HYDRAULIC EXCAVATORS

model

serial no.

Almost half a century of design and manufacturing experience has gone into your new Hein-Werner machine. It is the finest equipment that this know-how and modern technology can produce. We congratulate you on your selection.

We recommend that you become familiar with this manual and the maintenance procedures outlined herein. Following these instructions and operating the machine in a proper manner will assure you of long, dependable and profitable service.

Hein-Werner
CORPORATION
CONSTRUCTION EQUIPMENT DIVISION
WAUKESHA, WISCONSIN 53187

INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS

To assure prompt and accurate service, include the following data with each parts order:

1. Model and Serial number of machine
2. Part numbers
3. Part descriptions
4. Quantity of each part desired
5. Correct shipping destination
6. Method of transportation

Confirm all telephone and telegraph orders in writing. Be sure these orders are marked "Confirmation," to avoid duplication of orders.

WHERE TO ORDER PARTS

Hein-Werner Dealers are conveniently located throughout the United States and Canada. These Dealers maintain a stock of genuine Hein-Werner replacement parts. Always order parts from your nearest Hein-Werner Dealer.

INSPECTION OF SHIPMENTS

Carefully inspect all shipments upon arrival. In the event of loss or damage, do not accept the shipment until the transportation company either makes a notation on the freight bill, or gives you an inspection report covering said damage or loss. In the event of concealed damage or loss, notify the carrier at once (within 20 days) requesting that an inspection be made and damage or loss be acknowledged.

ADJUSTMENTS AND RETURNS

Refer to the written Warranty in this manual for an explanation of Warranty policy. If you feel a Warranty claim is in order, consult your Dealer. Claims must be made through your Dealer within a 15 day period from the time a failure occurs. Parts returned directly to the factory, without Dealer Authorization, will not be accepted.

USE ONLY GENUINE HEIN-WERNER PARTS FOR MAXIMUM PERFORMANCE

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Hein-Werner Hydraulic Excavator Models C-10, C-10HD and C-12

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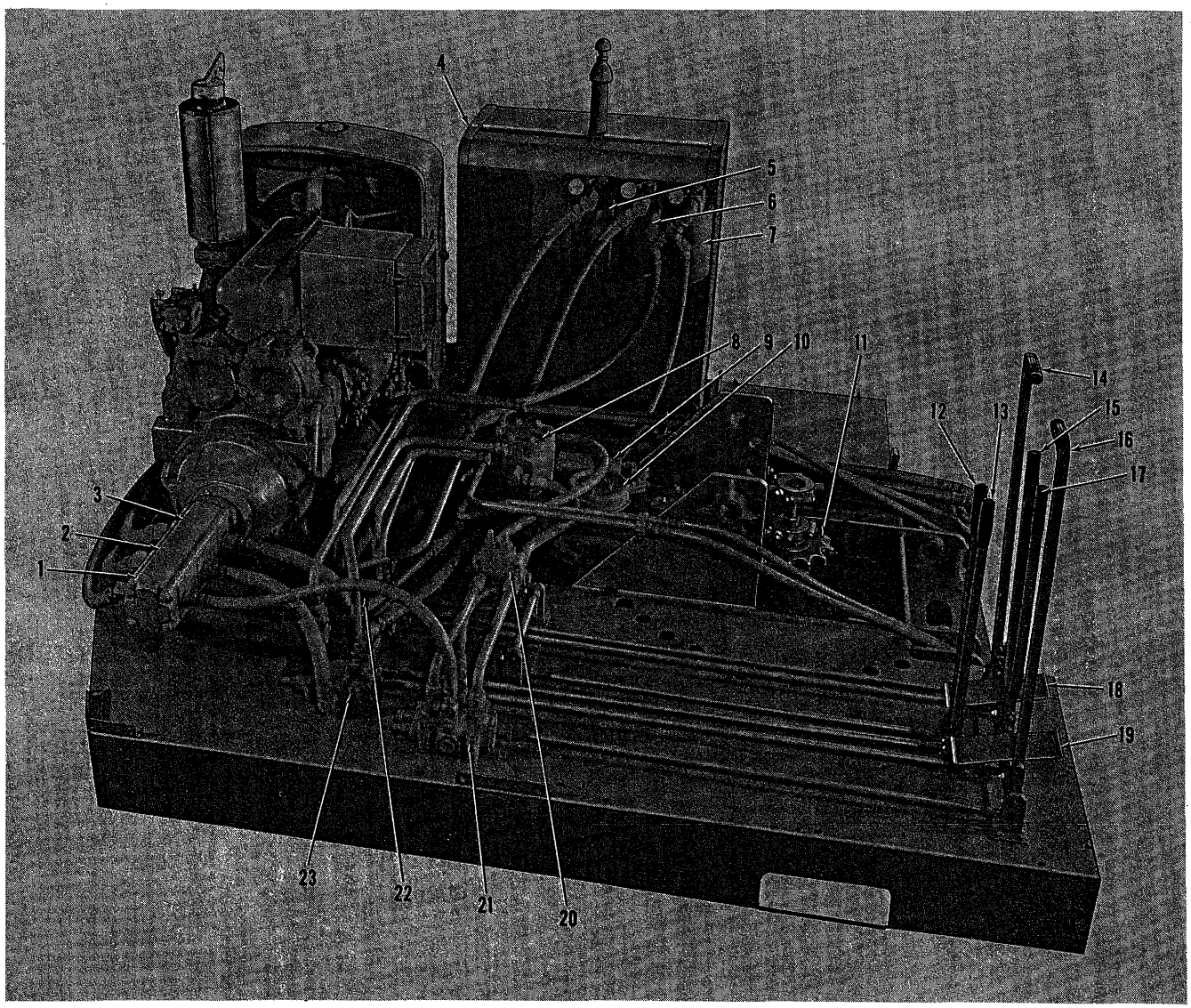

1. Swing system hydraulic pump section
2. Dipstick and propel system hydraulic pump section
3. Boom, propel, and bucket system hydraulic pump section
4. Hydraulic reservoir
5. Boom, propel, and bucket system filter
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12. Speed travel lever
13. Power travel lever
14. Boom control lever
15. Bucket control lever
16. Swing control lever
17. Dipstick control lever
18. Bucket control foot pedal
19. Dipstick control foot pedal
20. Swing system relief valve
21. Swing system control valve
22. Boom, propel, and bucket system control valve
23. Dipstick and propel system control valve

Figure 1. Machinery Platform

SECTION I
DESCRIPTION

GENERAL

This manual provides operating instructions, service information, and repair parts lists, for Model C-10, C-10HD, and C-12 crawler-mounted hydraulic excavators. Information in this manual is applicable to all models unless otherwise noted.

MACHINERY PLATFORM

The machinery platform (see figure 1) is fully reinforced at stress points to provide a rigid base for operating components. The location of components on the platform results in a well balanced rotating unit, and provides easy access for servicing all parts including hydraulic lines and connections.

The use of a three section tandem hydraulic pump, results in the elimination of gear drives and thus increases efficiency. This also provides each control valve with an independent oil supply for top response under all operating conditions.

The hydraulic reservoir is equipped with three separate suction hoses and three separate return hoses. The three return hoses are each equipped with a safety-flow oil filter with cleanable filtering elements. Disposable filtering elements are also available. Each filter has a back-pressure gage to indicate filtering effectiveness. If a filter element becomes clogged, the automatic by-pass valve in the filter will open to allow the oil to circulate.

SWING BEARING

The double row ball bearing swing bearing results in greater effectiveness, reduced maintenance, smoother rotation, and the elimination of such parts as king pins, rollers, roller paths, bushings, brackets, nuts, thrust washers, shims, etc. This greatly increased effectiveness is a result of the swing bearing's ability to absorb all axial, radial, and tilting forces; and to distribute them over a much wider area than is possible with conventional rollers. The swing bearing is bolted together to form a completely enclosed unit which eliminates adjustments and day-to-day maintenance other than lubrication.

Since the swing bearing is the only connection between the carbody and the machinery platform it eliminates any rocking motion except that permitted by the carbody as it moves over the terrain.

HOUSE BRAKE

An automatic "house brake" safety feature eliminates all drift and creep, even in the event of engine failure. The house brake is automatically actuated by spring force when the operator releases the swing lever or for any other reason that causes a lack of pressure to the swing circuit. When the swing circuit is in use, the house brake is automatically released by hydraulic pressure.

BOOM, DIPSTICK, AND BUCKET

The boom is made of high strength steel and is of extremely deep box section. Boom flange strength is further increased by the addition of an internal plate, and extra large reinforcing plates at the top, bottom, and sides which extend beyond the area of greatest stress concentration.

The dipstick is made of high strength steel and is internally reinforced.

The bucket is also reinforced at all high stress concentration points. The bucket teeth are pin connected and are individually replaceable.

All pivot points of the dipstick and bucket linkage are equipped with steel bushings and heat treated pivot pins to minimize wear.

CRAWLER UNDERBODY

The crawler underbody is equipped with split-chain sprockets, self cleaning tread and tumblers, and centrally located lubrication points on the side frames. The fully enclosed track adjustment eliminates "freezing". Double-flange track rollers provide maximum bearing surface in wear areas. Heavy ship-channel side frames, extra heavy shoes, and involute splined power shafting, are proof of its rugged, job-proven construction.

CAB AND CONTROLS

The cab provides excellent visibility and protection from the elements. The large front glass panel can easily be removed. All control lever linkage is above the machinery platform and away from mud and dirt. Controls are conveniently located and swing and boom levers can be interchanged for right or left hand operation if desired. The bucket and dipstick controls can be hand or foot operated (see figure 1).

The seat is adjustable in three directions. Instruments are conveniently grouped beneath the cab front window and includes an ammeter, fuel gage, oil pressure gage, and water temperature gage. An hour meter is mounted at the rear of the cab.

GEAR BOXES

Swing system and propel system gear boxes are precision bored and milled to assure precise gear line up for smooth long-life power transmission. All gears and shafts are accurately cut from alloy steel and heat treated. Shafts are carried by tapered roller bearings. The swing gear box is doweled to the machinery platform with specially ground studs which assures perfect mesh between the swing pinion and the swing gear at all times. The position of the propel box is adjustable to compensate for drive chain wear so that the correct chain slack can be maintained.

HYDRAULIC CYLINDERS

All hydraulic cylinders, with the exception of the house brake cylinder, are double acting. Cylinders are equipped with "V" type packings contained in bronze adapters. The bronze adapters eliminate direct contact between piston and cylinder walls and between cylinder rod and rod guide. Cylinder walls are honed to a fine finish. Piston rods are chrome plated, high carbon, specially treated alloy steel.

VALVES

All control valves have excellent "feathering" characteristics to assure smooth operation. All control valves are spring loaded to return to neutral position when the pressure on the control lever is released. Relief valves protect all hydraulic systems from overloading.

TOOL KIT

A tool kit is furnished with each machine and includes:

1 - Grease Gun
1 - Spanner Wrench
1 - 7/8" and 1" Open End Wrench
1 - 1-1/4" Open End Wrench
1 - 3/4" Drive Universal Joint
1 - Deep Throat 3/4" Drive 1-1/16" Socket
1 - Deep Throat 3/4" Drive 1-1/8" Socket
1 - Standard 3/4" Drive 15/16" Socket
1 - 3/4" Drive 12" Extension
1 - 15" Crescent Wrench
1 - 1-1/2" Special Tube Wrench
1 - Standard Sliding T 3/4" Drive
1 - Standard 3/4" Drive 1-13/16" Socket
1 - 1-3/8" Open End Wrench

ENGINE

Power is supplied by either a gasoline or diesel engine. The make of engine is optional. Refer to the engine manual provided with your machine for operating instructions, service information, and repair parts lists.

HYDRAULIC PUMP DRIVE

The three section tandem hydraulic pump is driven using either a solid drive shaft, or a clutch (see figure 2). The clutch is optional equipment and varies depending upon the engine used to power the machine. If your machine is equipped with a clutch, refer to the clutch kit parts list which is enclosed with this manual.

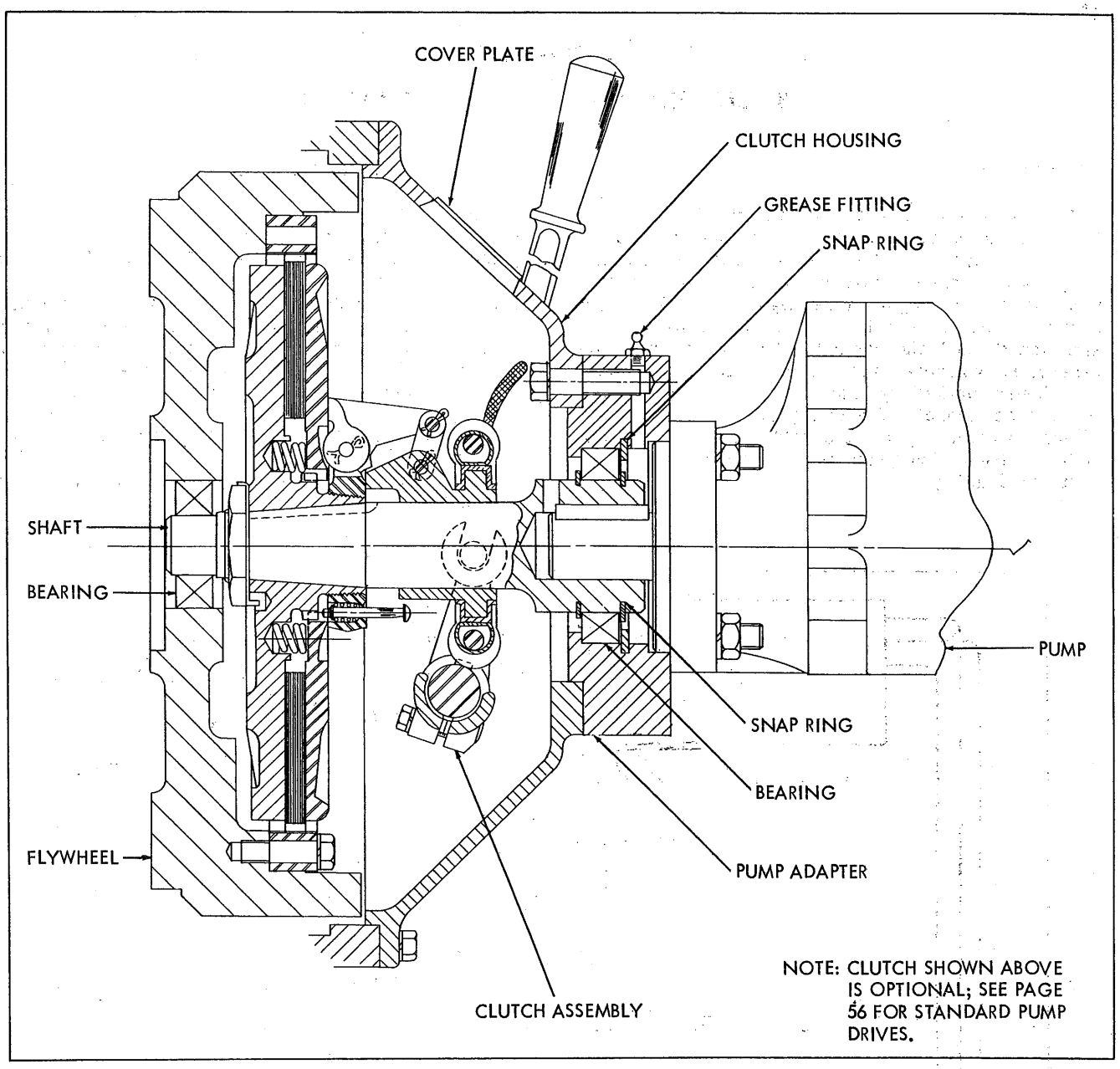

Figure 2. Cross-Sectional View of Clutch

SECTION II
BASIC PRINCIPLES OF OPERATION

SWING SYSTEM

The swing system gear box is driven by a hydraulic motor to provide unlimited swing in either direction. The swing system is powered through the single spool control valve by the pump section furthest from the engine (see figure 3). When the swing system is not in use, oil flows without restriction through the control valve and filter to the reservoir. Whenever the swing system is in use, the "house brake" cylinder is actuated to release the "house brake". The swing system is protected against overloading by a cushioning or cross-over relief valve which protects the swing mechanism from overloading.

DIPSTICK AND PROPEL SYSTEM

The dipstick and propel circuits are powered through the two spool control valve by the center pump section (see figure 4). When the dipstick or propel systems are not in use, oil flows without restriction through the control valve and filter to the reservoir. When either circuit is in use, the control valve relief protects that circuit from being overloaded by limiting pressure to a specified maximum. An in-line relief valve protects against overloading by allowing the dipstick to open when the dipstick is loaded as a result of leverage caused by working of the boom or bucket. A cushioning valve protects the propel motor from overloading due to external reasons.

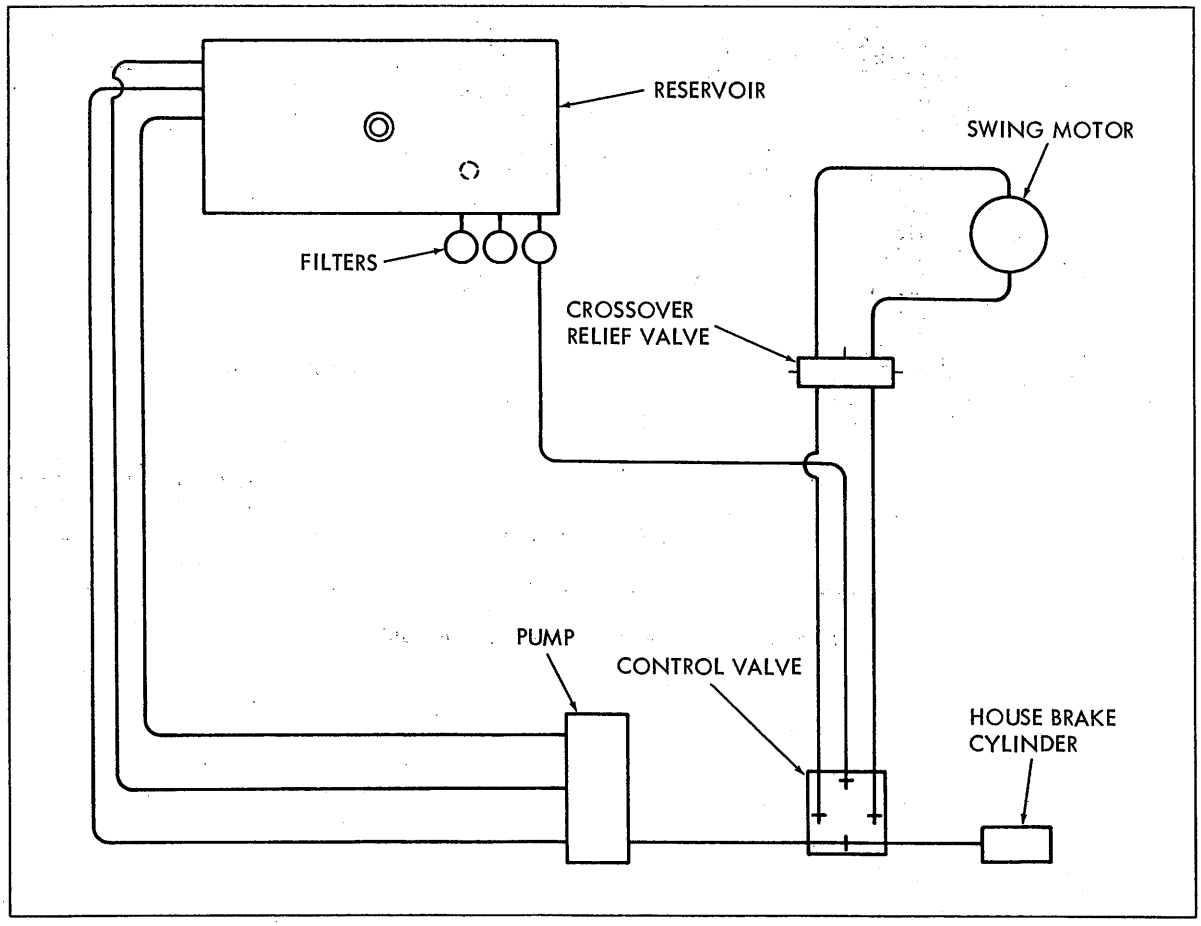

Figure 3. Swing System Hydraulic Schematic

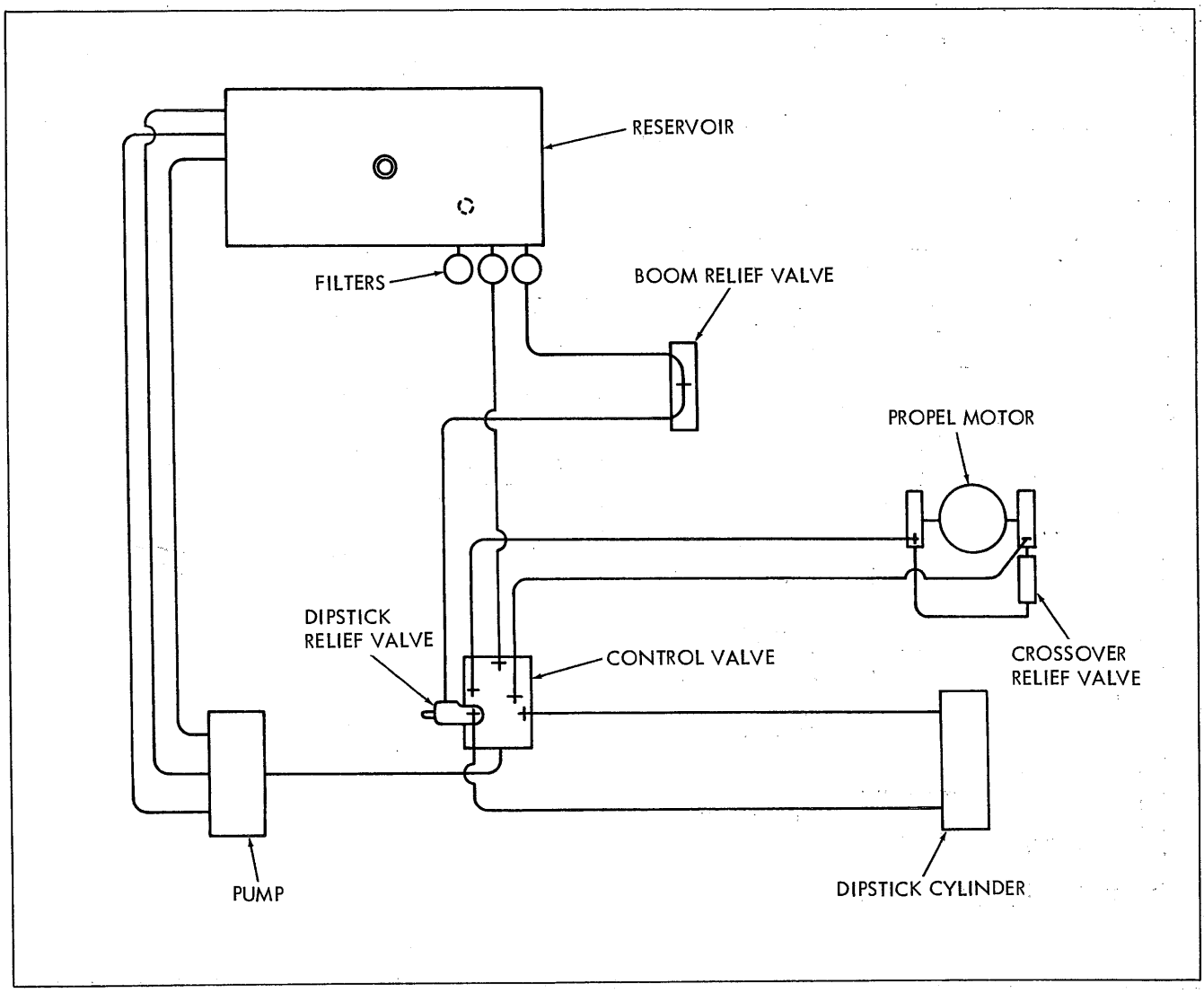

Figure 4. Dipstick and Propel System Hydraulic Schematic

BOOM, BUCKET, AND PROPEL SYSTEM

The boom, bucket, and two speed propel systems are powered through the three spool control valve by the pump section nearest the engine (see figure 5). When the system is not in use, oil flows without restriction through the valve and filter to the reservoir. The control valve contains a relief valve that prevents excessive pressure build-up in the circuits controlled by this valve. An in-line relief valve protects the boom against overloading by allowing the boom to rise when it is loaded as a result of leverage caused by working of the dipstick or bucket.

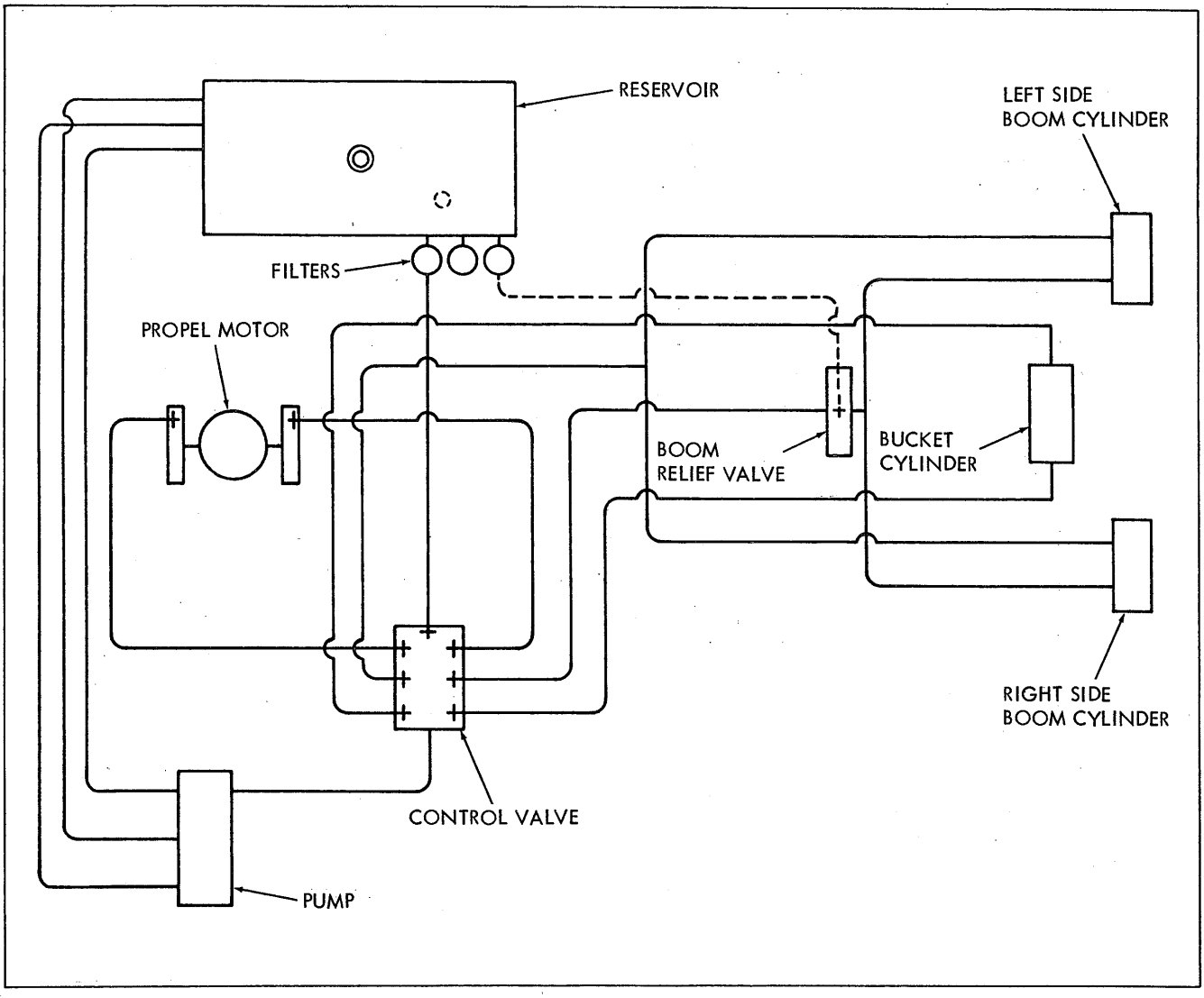

Figure 5. Boom, Bucket, and Propel System Hydraulic Schematic

SECTION III
OPERATION

PREPARATION FOR USE

Inspect the machine for security of fuel, hydraulic, and electrical connections. Tighten connections or attaching parts as required. Check engine belt tension. Inspect for evidence of damage which may have occurred during shipment. Operate all controls to be sure they are operating freely.

Check oil level in hydraulic reservoir by removing high level plug in end of reservoir. Oil level in reservoir must not exceed high level plug and must not be lower than low level plug. If necessary, add oil conforming to specifications in Section IV.

Check level of lubricant in swing and propel gear boxes. If necessary, add lubricant conforming to specifications in Section IV.

Check fuel supply and fill fuel tank with fuel conforming to specifications in engine service manual.

Check coolant level and add as necessary.

Check air cleaner in accordance with instructions in engine service manual. Clean or add oil as required.

Check engine oil level and add oil as required according to specifications in engine service manual.

Check level of electrolyte in battery and add clean or distilled water as required. Check battery and terminals for corrosion and clean as required.

Lubricate all points as specified in Section IV and in engine service manual.

NOTE

After four to eight hours of initial operation, hydraulic cylinder packing flanges must be tightened to prevent excessive escape of hydraulic oil around the cylinder rods. Do not overtighten, as a small seepage of oil at these points is necessary for cylinder rod lubrication.

STARTING THE ENGINE

Leave all control levers in neutral. Place throttle in approximately half-fuel position. Place ON-OFF switch in ON position or place fuel shut-off lever in RUN position. Depress starter button to crank engine. If engine fails to start after two or three cranking attempts, refer to engine service manual for cause of trouble and instructions to correct it.

USE OF OPERATING CONTROLS

All control valves have excellent "feathering" characteristics to assure smooth operation and are spring loaded to return to neutral position when pressure is released on control lever. Apply gradual pressure to operate control levers and maintain a slight pressure on control levers when moving them to neutral position.

NOTE

Operators not familiar with hydraulic machines may tend to over-control and cause rough operation of the machine. It is recommended that the machine be operated at half throttle or less until the operator gets the "feel" of the controls. The throttle setting may then be gradually increased to full governed speed as the operator becomes more familiar with the control system and control valve feathering characteristics.

Use of Boom Control Lever

To raise boom, pull boom control lever (figure 6) back.

To hold boom in position, move control lever to center position (neutral).

To lower boom, push boom control lever forward.

Use of Bucket Control Pedal or Lever

For normal operation, use bucket foot pedal to operate bucket. However, for very close work when speed is not a factor, use bucket control lever to control critical movement of bucket (see figure 6).

To place bucket in closed position, push down with heel of left foot on bucket control foot pedal, or pull bucket control lever back.

To hold bucket in position, move bucket control foot pedal or lever to center position (neutral).

To place bucket in open position, push down with toe of left foot on bucket control foot pedal, or push bucket control lever forward.

Use of Dipstick Control Pedal or Lever

For normal operation, use dipstick control foot pedal to operate dipstick. However, for very close work when speed is not a factor, use dipstick control lever to control critical movement of dipstick (see figure 6).

To tuck dipstick in, push down with heel of right foot on dipstick control foot pedal, or pull dipstick lever back.

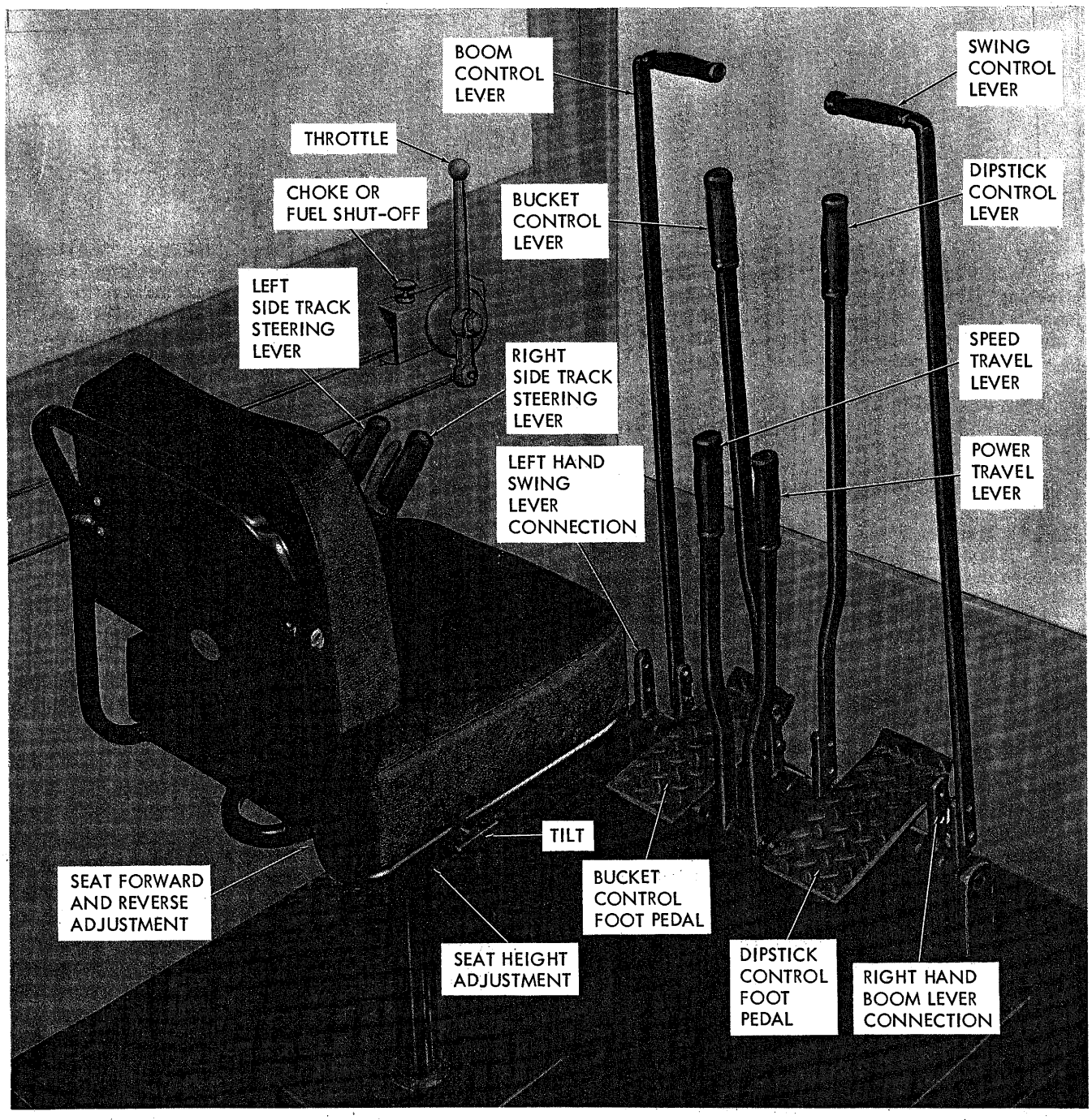

Figure 6. Operating Controls

To hold dipstick in place, move dipstick control foot pedal or lever to center position (neutral).

To open dipstick, push down with toe of the right foot on dipstick control foot pedal, or push dipstick control lever forward.

Use of Swing Control Lever

To swing platform in a clockwise direction, pull swing control lever (figure 6) back.

To hold platform in position, move swing control lever to center position (neutral).

To swing platform in a counterclockwise direction, push control lever forward.

The swing and propel systems operate independently of each other. Therefore, the swing system can be operated while the unit is being propelled.

Use of Propelling Controls

To propel machine straight ahead, (drive sprockets to the rear), place both steering levers in upper position to engage jaw clutches and release drive brakes. Push right hand travel lever forward. To

increase propelling speed, also push left hand travel lever forward. To propel machine straight backwards, follow same procedure, except pull travel lever(s) back.

To propel machine ahead and to the right, place only left side track steering lever in upper position and push right hand travel lever forward. To increase propelling speed, also push left hand travel lever forward. To propel machine backwards and to the right, follow same procedure, except pull travel lever(s) back.

To propel machine ahead and to the left, place only right side steering lever in upper position and push right hand travel lever forward. To increase propelling speed, also push left hand travel lever forward. To propel machine backwards and to the right, follow same procedure, except pull travel lever(s) back.

When traveling straight forwards or backwards, relieve pressure on the travel lever(s) before using either steering lever to turn machine. This is necessary to relieve pressure on jaw clutches so they will disengage easily.

When performing digging operations, both steering levers must be pushed forward and set to apply both track drive brakes and prevent movement of the unit. This procedure may not be necessary in many cases where the machine will remain stationary while digging in loose materials.

DIGGING HINTS

Keep the work as close to the machine as possible. This results in a greater mechanical advantage and also cuts down the cycle time. By starting a cut with the dipstick at right angles to the boom point, cycle time can be decreased because the boom does not have to be repositioned as often.

By tucking the dipstick as the boom is raised out of a cut, the top of the cut can be cleared sooner cutting down cycle time. Square cuts for manholes, etc., can be made easier by moving the machine in-line with each bank, rather than using the swing to get from bank to bank. Straight down end cuts can be made by extending the dipstick and bucket and moving the machine forward or back to reach the bottom of the cut. To decrease cycle time, especially in a deep cut, shave off a layer at a time, rather than going to the bottom of the cut on every cycle. Rocks and stumps can be uncovered, undermined, and pried out using the bucket.

For faster dumping, open both the bucket and the dipstick. When digging in gravel, stones, or shale, use the bucket teeth to loosen the material so that the bucket can be filled on the next cycle. When digging in clay or hard soil, use the bucket in a flat position and shave or peel the soil by moving the boom and dipstick.

USE OF ATTACHMENTS

The bucket can be removed and reattached in an inverted position to use the machine for shovel operation. Digging buckets are available in widths from 16 to 48 inches. A 60 inch wide ditch bucket is available for ditch cleaning or material handling, and can also be used in either backhoe or shovel position.

Also available are a clamshell bucket, a log grab, a pulpwood grapple and a frost point.

STOPPING THE ENGINE

Reduce engine speed to idle. Allow engine to operate at idle speed for approximately five minutes to normalize engine temperature before placing ON-OFF switch or fuel shut off lever in OFF position to stop engine. If the engine continues to run after the fuel shut-off lever is placed in OFF position, pull emergency stop knob located on back wall of cab. This will shut off the air supply to the engine by tripping the air shut-off valve. If air shut-off valve has been tripped, it must be reset before the engine can be operated. To reset the air shut-off valve, first push the emergency stop knob all the way in, and then manually reset the air shut-off valve latch.

NOTE

Sudden stoppage of the engine is not recommended unless absolutely necessary.

PREPARATION FOR STORAGE

If the machine is to be stored for an indefinite length of time, the following procedures are recommended, subject to the anticipated storage period.

1. Drain fuel system and refill with Valvoline Oil Company "Tectyl 503-C" rust preventative compound or its equivalent.
2. Drain engine lubricant and refill with engine preservative oil.
3. Drain engine cooling system and refill with corrosion inhibitor.
4. Crank engine to circulate preservative oils through fuel and lubricating systems.
5. Drain lubricant from swing and propel gear boxes and refill with preservative oil.

CAUTION

Wherever fluid systems have been drained, a waterproof tag should be affixed to the tank or engine, cautioning operator not to operate the machine until system(s) have been drained and refilled with correct operating fluid.

6. Remove battery.
7. Relieve engine belt tension. Tag belts indicating that belt tension must be adjusted before starting engine.
8. Wipe machine to remove film and dirt. Apply preservative to any exposed metal surfaces subject to corrosion through prolonged non-usage, such as valve spools, cylinder rods, etc.
9. Close and secure all doors. Seal all openings with waterproof paper.
10. Fill hydraulic system completely with hydraulic oil.

SECTION IV
MAINTENANCE

GENERAL

Proper care and operation of your machine will prevent unnecessary repairs and downtime. This section contains a periodic inspection schedule along with necessary operating adjustments, and lubrication recommendations, which will help you to get the optimum performance from your machine.

PERIODIC INSPECTION SCHEDULE

FREQUENCY	INSPECTION OR SERVICE TO BE PERFORMED
Daily	Lubricate as required.
Daily	Check engine lubricating oil supply.
Daily	Check engine coolant supply.
Daily	Inspect for and correct any fuel, oil, coolant, or hydraulic system leaks.
Daily	Check level of hydraulic oil in reservoir.
Daily	Check level of lubricant in propel and swing system gear boxes.
Daily	Check level of electrolyte in battery coils.
Daily	Check back pressure indication on filter gages; clean or replace elements as necessary.
Daily	Check engine drive belt tension.
Weekly	Lubricate as required.
Monthly	Check slack in propel system drive chains; adjust as required.
Monthly	Inspect propel system brakes; adjust as required.
Monthly	Check hydraulic system pressures.
Monthly	Check all mechanical linkage connections.
Monthly	Inspect all hydraulic system hoses for signs of possible trouble.
Monthly	Tighten any loose mounting bolts or nuts.
As required	Inspect bucket teeth and replace as necessary. Do not use shanks without teeth for digging.
As required	Remove filler screen from hydraulic reservoir. Clean screen thoroughly with cleaning solvent and replace in reservoir. **CAUTION** Filler screen should be removed only for cleaning and must always be in place when filling or adding oil to hydraulic reservoir.

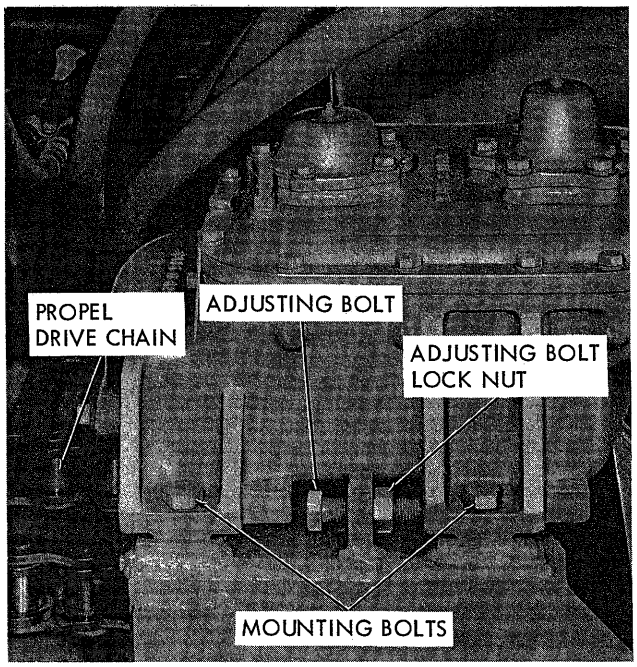

Figure 7. Propel Drive Chain Adjustment

PROPEL DRIVE CHAIN ADJUSTMENT

Check propel drive chain for 7/16 to 11/16 inch deflection on slack side of chain (see figure 7). If necessary to adjust, proceed as follows:

1. Loosen propel gear box mounting bolts which attach gear box to mounting frame.
2. Loosen both adjusting bolt lock nuts and tighten each adjusting bolt equally to adjust chain until deflection is 7/16 to 11/16 inch.
3. Tighten both adjusting bolt lock nuts and then tighten gear box mounting bolts.

CRAWLER TRACK AND DRIVE CHAIN ADJUSTMENT

1. Remove cotter pins and lock pins on each side of tracks at drive sprocket end (see figure 8).
2. Adjust the track adjusting nut until there is 7/16-11/16 inch deflection in drive chain. Adjust both adjusting nuts equally to keep the tumblers and drive sprocket in proper alignment. (Note: It may be necessary to loosen the track adjusting nuts at idler end to obtain sufficient slack to tighten the drive chain).
3. Replace lock pins and cotter pins.
4. Remove the cotter pins and lock pins from the track adjusting nut on each side of the tracks at idler end.
5. Adjust the track tension until some slack exists. (Note: Adjust both adjusting nuts equally to keep the tumblers in proper alignment).
6. Replace lock pins and cotter pins. (Note: Chain and track must not be tight).

CRAWLER BRAKE AND JAW CLUTCH ADJUSTMENT

To compensate for brake lining wear it is necessary to periodically adjust crawler brake linkage. Brake lining wear will be indicated when the brake and clutch levers travel too far down the ratchet and the braking action is not sufficient. Since the same levers control the jaw clutches, it is necessary to check the jaw clutch clearance when adjusting brakes. If necessary to adjust, proceed as follows: (See figure 9.)

1. Release crawler brake and engage jaw clutch.

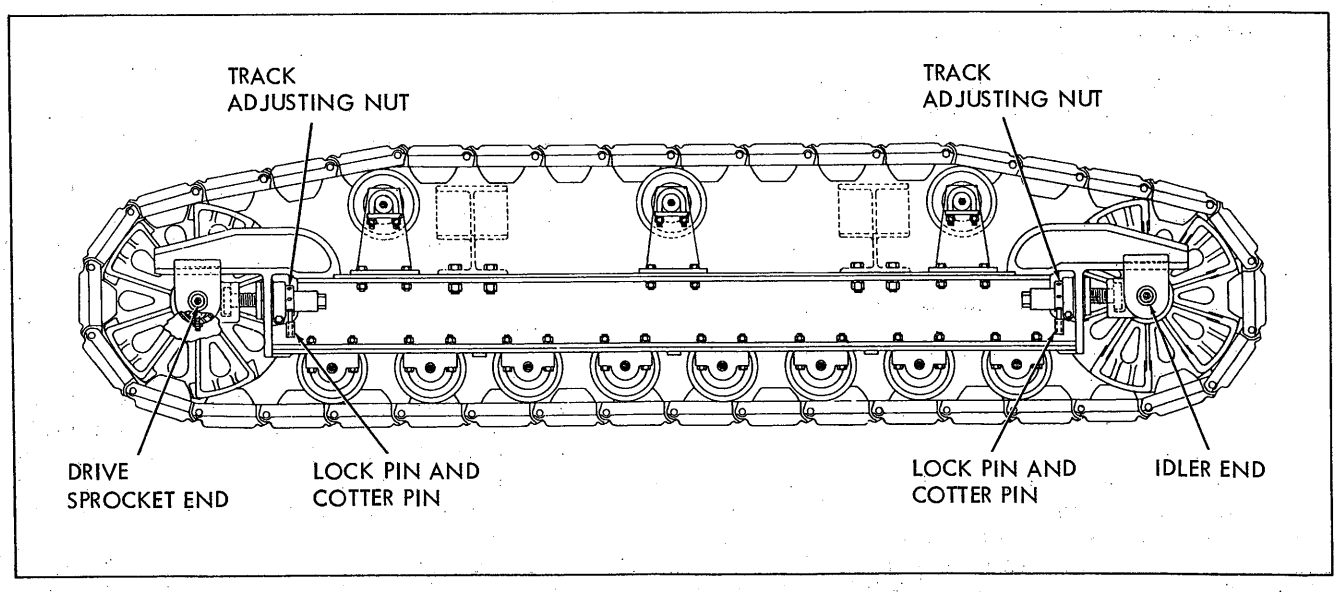

Figure 8. Crawler Track and Drive Chain Adjustment

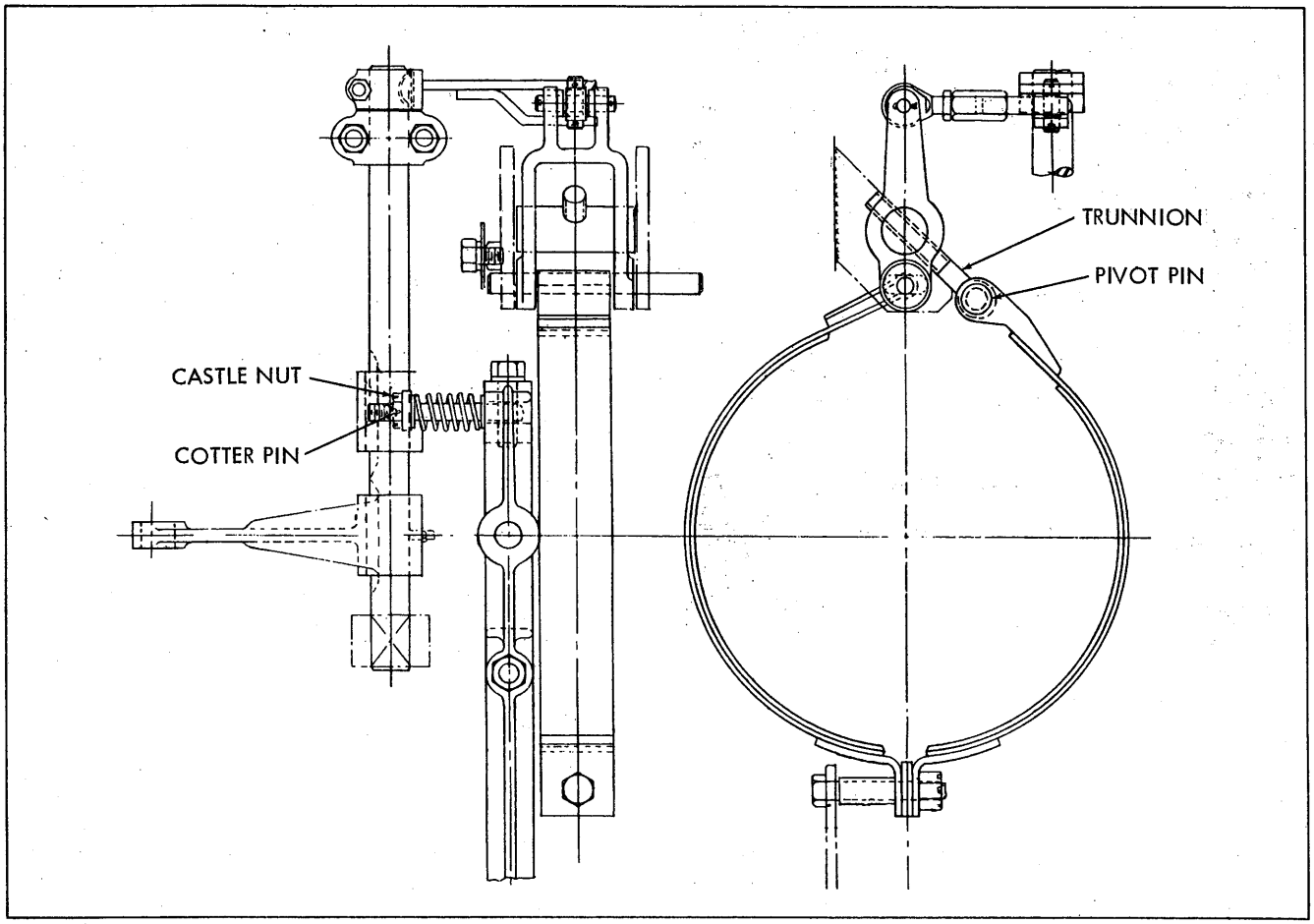

Figure 9. Crawler Brake and Jaw Brake Adjustment

2. Remove cotter pin from trunnion and remove pivot pin.

3. Rotate trunnion in a clockwise direction to obtain sufficient braking power.

4. Check for 1/8 inch minimum clearance between stationary and sliding members of the jaw clutch when the brake is applied.

If this 1/8 inch minimum clearance does not exist, proceed as follows:

1. Remove castle nut cotter pin.
2. Tighten castle nut until proper clearance exists.
3. Place lever in travel position and check for proper mesh of jaw clutch.

CONTROL VALVE PRESSURE CHECK

The correct control and relief valve adjustments have been made before shipping from the factory. Only factory and dealer representatives are authorized to adjust valve pressure settings. TAMPERING WITH THE PRESSURE SETTINGS WILL RESULT IN VOIDING THE WARRANTY OF THE UNIT. However, in the event of malfunction of the unit and also at periodic intervals, the pressure settings should be checked as follows:

NOTE

Be sure gage is indicating correctly. Check gage against master gage to insure accuracy.

1. Boom Circuit Pressure Check. Install 0-3000 psi pressure gage in boom cylinder testing port (see figure 10). Run engine at full throttle and pressurize boom cylinder rod end by pushing boom control lever forward. Boom cylinder pressure gage should indicate 1650 to 1700 psi.

2. Bucket Circuit Pressure Check. Install 0-3000 psi pressure gage in bucket cylinder testing port (see figure 11). Run engine at full throttle and pressurize bucket cylinder rod end by pushing bucket control lever forward. Bucket cylinder pressure gage should indicate 1650 to 1700 psi.

3. Dipstick Circuit Pressure Check. Install 0-3000 psi pressure gage in dipstick cylinder testing port (see figure 12) at the base end of cylinder.

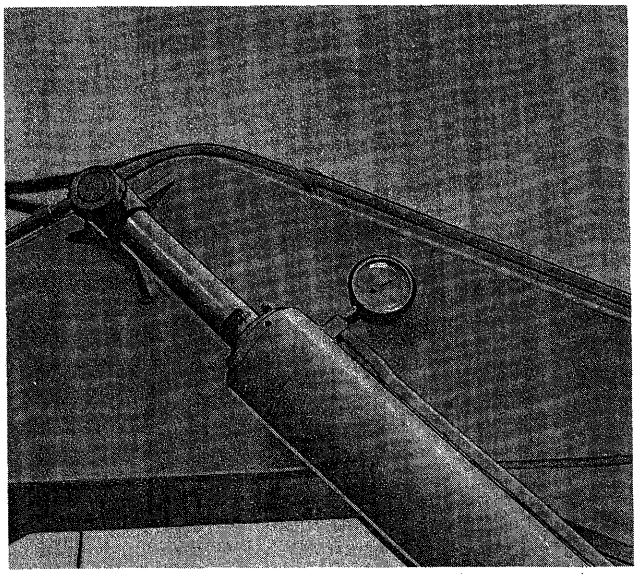

Figure 10. Pressure Gage Installed in Boom Cylinder Testing Port

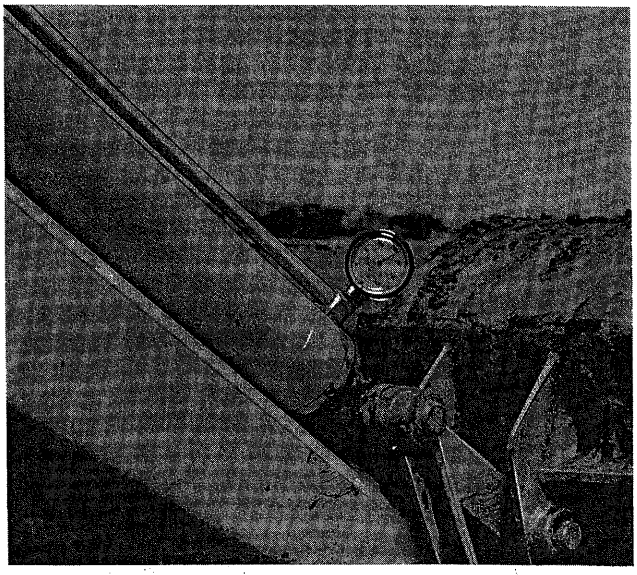

Figure 11. Pressure Gage Installed in Bucket Cylinder Testing Port

Run engine at full throttle and pressurize dipstick cylinder base end by pulling dipstick control lever back. Pressure gage in base end of dipstick cylinder should indicate 1900-1950.

4. Propel Circuit Pressure Check. Place machine so that forward and backward travel are completely blocked. Install 0-3000 psi pressure gage in propel motor cross-over valve testing port (see figure 13). Run engine at full throttle with both steering levers in upper position to engage jaw clutches and release brakes, and push right hand travel lever forward to pressurize propel circuit for forward travel. Pressure gage in forward travel testing port of crossover valve should indicate 1900-1950 psi.

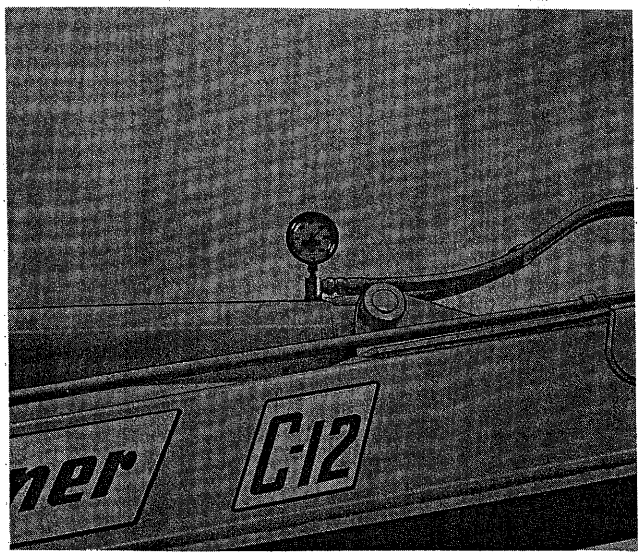

Figure 12. Pressure Gage Installed in Dipstick Cylinder Testing Port

Repeat same procedure, except push left hand travel lever forward to pressurize propel circuit. Pressure gage should indicate 1650-1700 psi.

5. Swing Circuit Pressure Check. Place unit so that swing is completely blocked in both directions. Install 0-3000 psi pressure gages in swing motor crossover valve testing ports (see figure 14). Run engine at full throttle and pressurize swing circuit for clockwise swing by pulling swing control lever back. Pressure gage in clockwise swing testing port should indicate 1650 to 1700 psi. Run engine at full throttle and

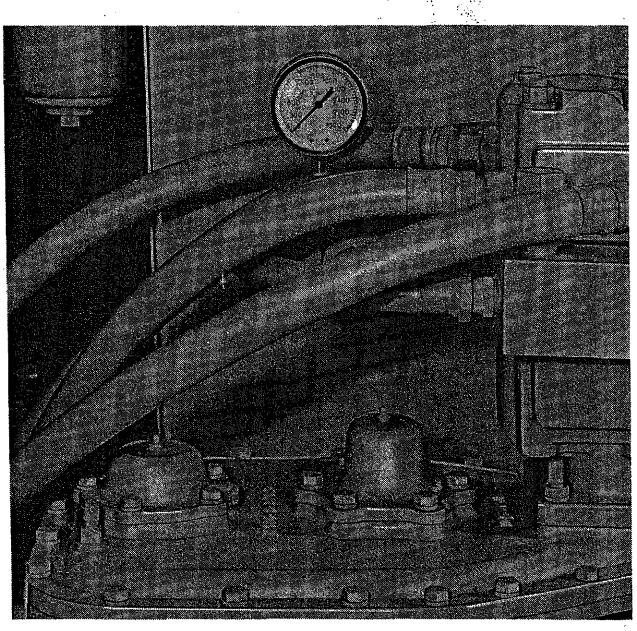

Figure 13. Pressure Gage Installed in Propel Motor Crossover Valve Testing Port

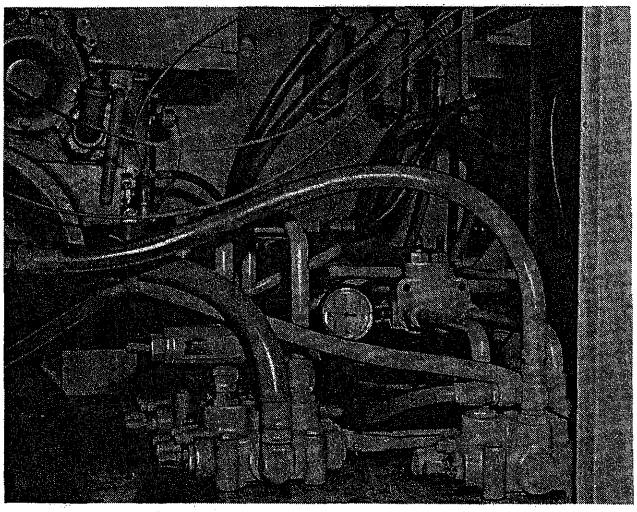

Figure 14. Pressure Gage Installed in Swing Motor Crossover Valve Testing Port

pressurize swing circuit for counterclockwise swing by pushing swing control lever forward. Pressure gage in counterclockwise swing testing port should indicate 1650 to 1700 psi.

LUBRICATION

To assure maximum efficiency and long life of the machine, be sure to use the proper viscosity and grade of the recommended lubricants or their equivalent.

Lubricate the machine at the points indicated in figures 15, 16, 17 and 18. Lubricate engine as recommended in engine service manual.

NOTE

Be sure to remove any excess grease after lubrication of the machine, or dirt and dust will accumulate and may work into bushings and bearings.

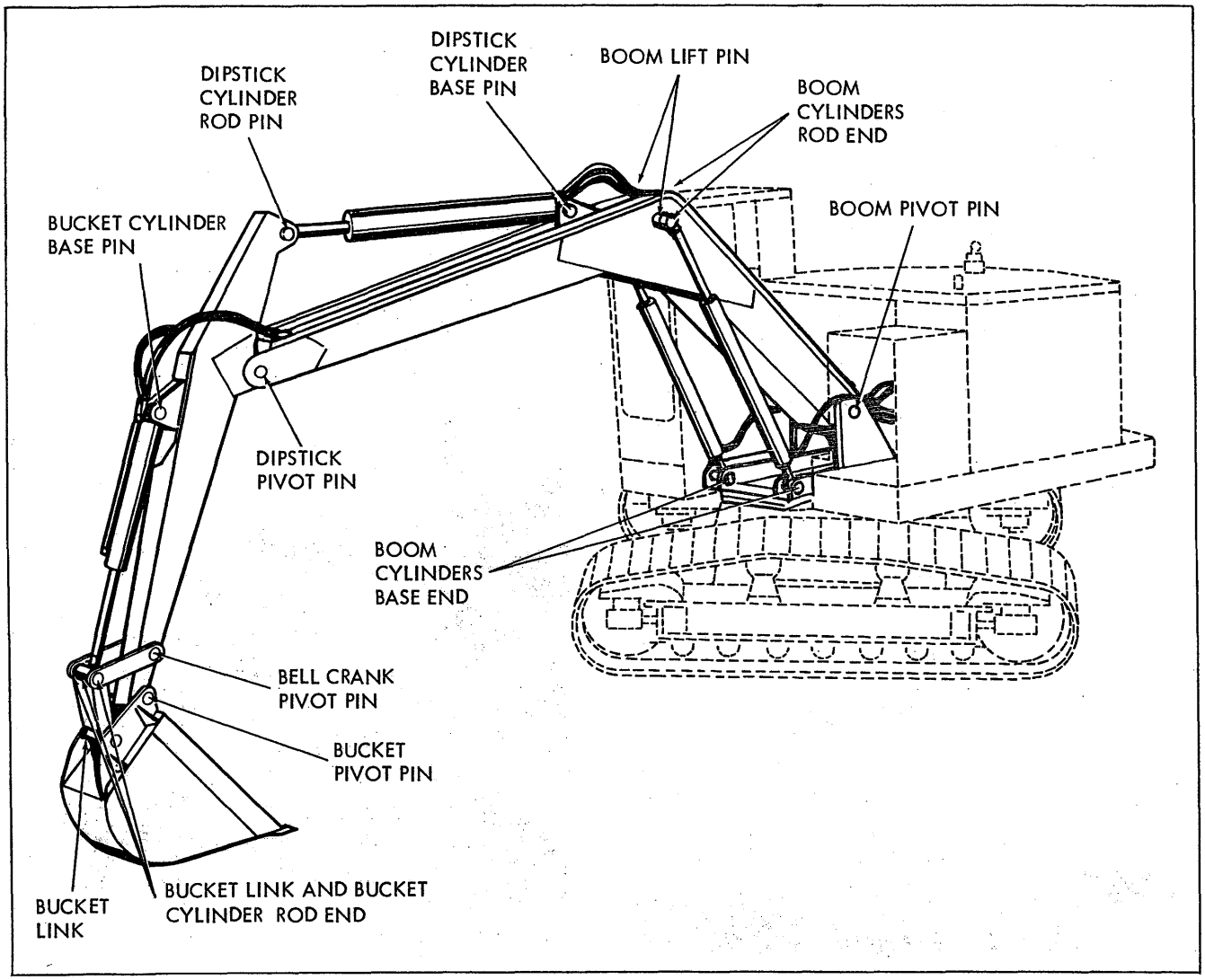

Figure 15. Lubrication Diagram for Upperworks

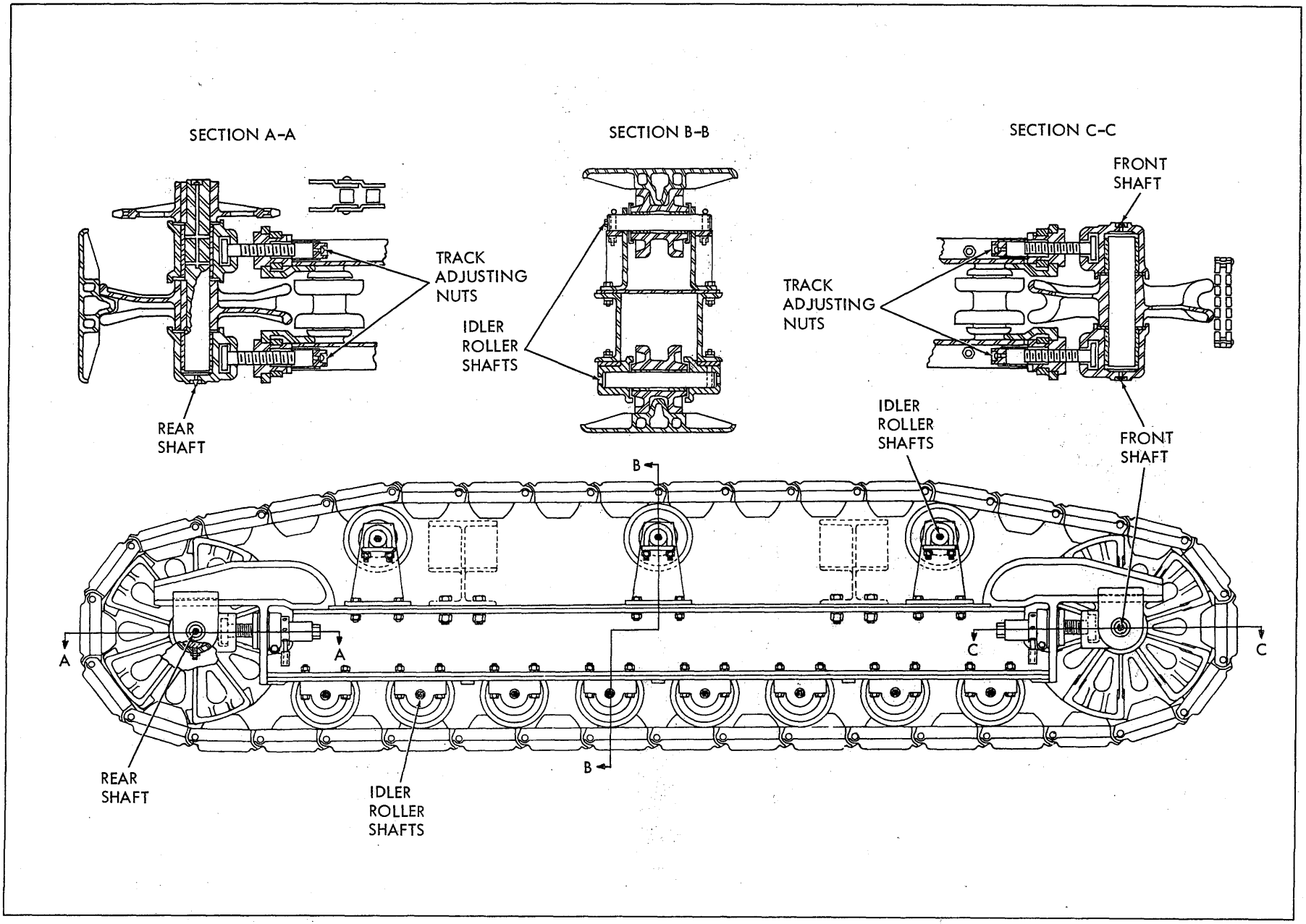

Figure 16. Lubrication Diagram for Crawlers

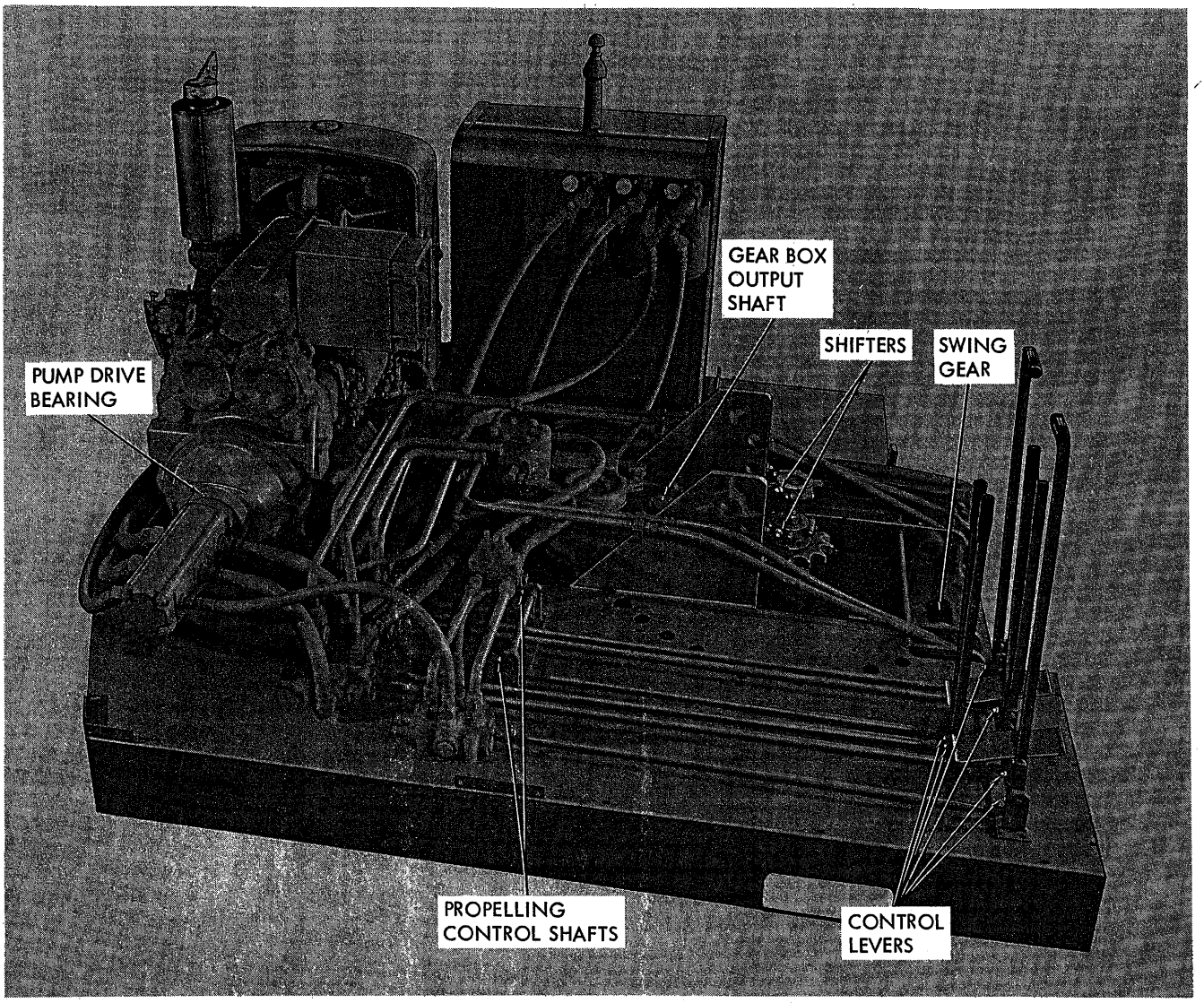

Figure 17. Lubrication Diagram for Machinery Platform

Do not lubricate crawler underbody propel drive chains. Be sure to lubricate all lubrication points of crawler underbody daily, even though the machine has not been traveling, since there is movement when digging and swinging.

Be sure to check indication of oil filter gages daily. The filter element needs cleaning (cleanable type) or replacement (disposable type) whenever the gage needle indicates in the red range. If cleaning or replacing one filter element, be sure to clean or replace the other two elements at the same time.

When the machine is shipped from the factory, the hydraulic system is filled with a premium grade hydraulic oil which is compatible with any premium grade SAE 20 mill or engine oil. When extreme temperature conditions are encountered, consult the factory for hydraulic system oil recommendations.

CAUTION

Do not, under any circumstances, dilute the hydraulic system oil with kerosene. The hydraulic system components depend on the lubricating properties of the hydraulic system oil.

LUBRICATION RECOMMENDATIONS

PART	LUBRICANT	FREQUENCY
Gear boxes	EP 80-90 oil	Add as required to maintain level.
Cross-propel shaft housing (filler pipe at front of carbody)	EP 80-90 oil	Add as required to maintain level. Capacity is one quart.
Open gears and upper propel drive chain	Crater compound.	Inspect visually twice daily. Apply lubricant as required.
Swing bearing (4 fittings)	Mobilux GR #2 or equivalent.	Weekly. 1/4 to 1/2 lb. per fitting.
Gear box bearing grease fittings	Mobil No. 5 grease, or equivalent.	Weekly.
Pump drive grease fitting	Moly type grease, such as Mobiloil Special or equivalent.	Weekly.
All other grease fittings	Moly type grease, such as Mobiloil Special or equivalent.	Daily or more often if required by operation conditions.
Hydraulic reservoir	Premium grade SAE 20 oil.	Add as required to maintain level.

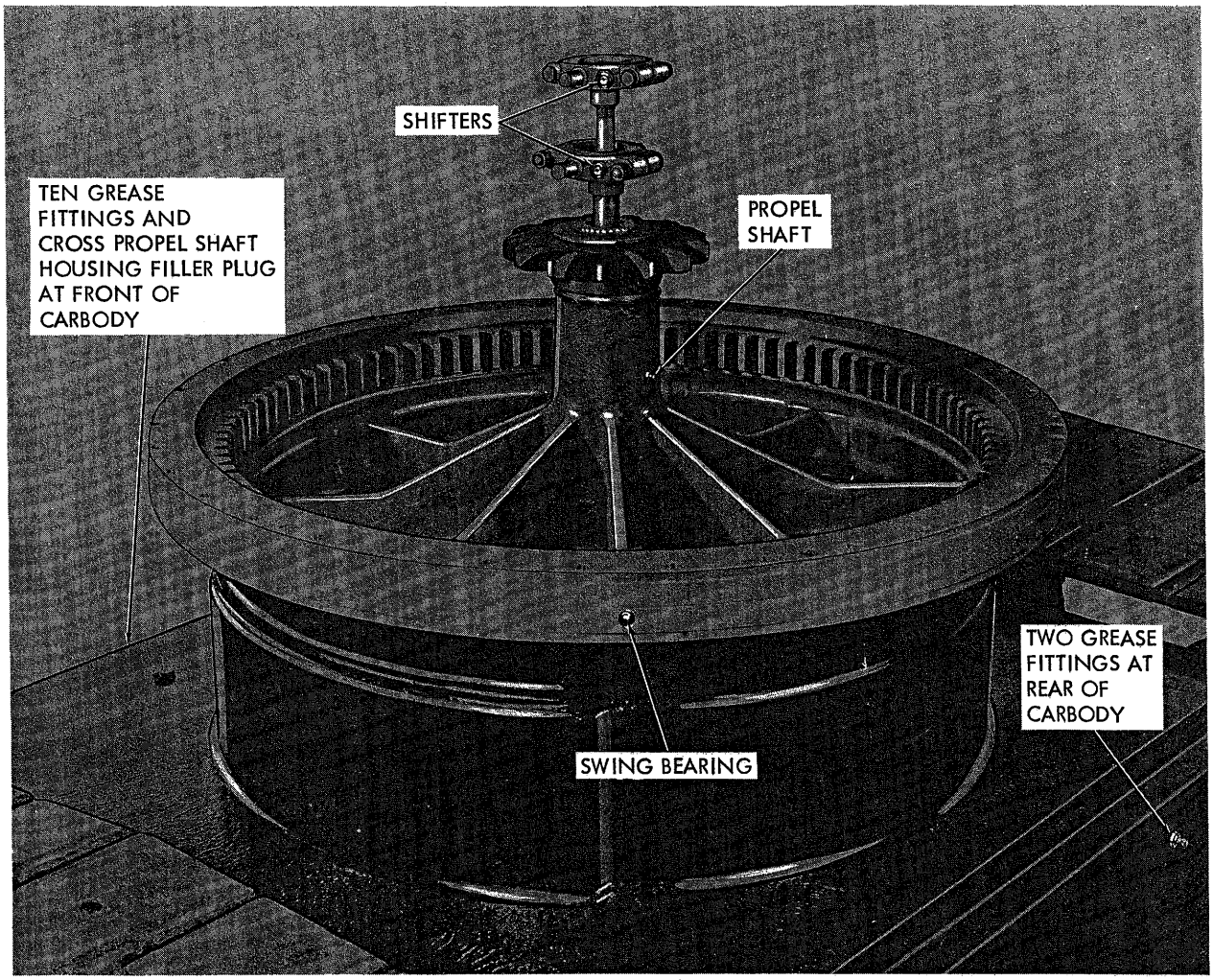
SHIFTERS
TEN GREASE FITTINGS AND CROSS PROPEL SHAFT HOUSING FILLER PLUG AT FRONT OF CARBODY
PROPEL SHAFT
TWO GREASE FITTINGS AT REAR OF CARBODY
SWING BEARING

Figure 18. Lubrication Diagram for Swing Bearing and Carbody

SECTION V
TROUBLE SHOOTING AND SERVICE

TROUBLE	PROBABLE CAUSE
No cylinder actuation or slow cylinder actuation.	1. No pump rotation due to damaged drive. 2. Damaged or worn pump. 3. Clogged supply line(s). 4. Insufficient engine speed (refer to engine manual to adjust governed speed). 5. Damaged or worn cylinder (if pressure to cylinder is correct. 6. Relief valve stuck open, worn, or damaged (if pressure to cylinder is insufficient). 7. Misadjusted valve(s).
Noisy hydraulic pump.	1. Worn or damaged pump section(s). 2. Lack of oil to pump. 3. Loose pump drive mounting causing drive shaft misalignment.
Cylinders do not hold boom, bucket, and/or dipstick in position.	1. Excessive internal cylinder leakage past piston. 2. Exessive internal leakage in control valve(s).
Excessive pressure required to operate controls.	1. Oil temperature too high. 2. Damaged control valve(s). 3. Damaged linkage to control valve(s).
Propel system inoperative.	1. Worn or damaged propel motor. 2. Incorrect jaw clutch and brake adjustment. 3. Broken propel drive or driven chain(s). 4. Worn or damaged propel gear box. 5. Cross-over relief valve is by-passing oil.
Swing system inoperative.	1. Worn or damaged swing motor. 2. Worn or damaged swing control valve. 3. Worn or damaged swing gear box. 4. Cross-over relief valve is by-passing oil.

TROUBLE	PROBABLE CAUSE
Platform creeps or drifts when swing lever is in neutral.	1. Broken spring(s) in brake cylinder. 2. Broken linkage to brake cylinder. 3. Brake shoes worn. 4. Internal leakage in swing control valve.
House brake will not release.	1. Broken supply line to brake cylinder.
Controls do not return to neutral when released.	1. Broken return spring in control valve. 2. Sticky valve due to excessive oil temperature. 3. Binding in control lever assembly.

GEAR BOX SERVICE

The swing gear box and the propel gear box are of similar construction, except for the brake on the swing gear box. The following repair instructions are applicable to both gear boxes except as noted.

Removal of Swing Gear Box

Drain lubricant from gear box. Use swing lever to pressurize brake cylinder. Remove linkage which connects cylinder to gear box brake. Shut off engine and disconnect hydraulic line to cylinder. Disconnect hydraulic connections to swing motor. Remove nuts and lockwashers from four studs and remove gear box.

Removal of Propel Gear Box

Drain lubricant from gear box. Disconnect hydraulic connections to propel motor. Open interconnecting chain link and remove propel drive chain. Remove bolts and nuts which attach gear box to mounting frame and remove gear box.

Disassembly of Gear Boxes (see figure 19)

Remove swing and propel motors and house brake cylinder. Remove brake drum from swing gear box. Remove retaining ring and slide brake drum mounting adapter from intermediate shaft. Remove brake shoe return springs and brake shoes. Remove roller from actuating pawl. Remove brake shoe lever. Remove backing plate from gear box. Remove swing pinion from swing gear box and remove chain sprocket from propel gear box. Remove all bolts, nuts, and washers which hold cover to case. Remove the output and intermediate shaft covers from the gear box cover. Remove the nut and washer from the output shaft.

The upper end bearing is a press fit on the output shaft. Use of a puller to anchor on the cover and press against the shaft is recommended to remove the bearing from the shaft. This will also lift the cover from the case, which will expose all of the other gears and shafts.

Lift the intermediate shaft, pinion, gear, and bearing assembly from the case. Remove the input drive pinion and bearing assembly from the case.

Remove the snap ring from the output shaft and remove the final drive gear from the shaft. Remove the output shaft and bearing from the case by driving it out from the inside with a plastic hammer.

Remove remaining cups and oil seals from the case with a puller.

Place the output shaft in a press with the threaded end up and press the spacer, bearing and sleeve from the shaft.

Place the intermediate shaft in a press and press the intermediate driven gear and bearing from the shaft. Reverse the shaft and press the other bearing off with a puller.

Inspection of Gear Box Components

Clean all components thoroughly. It is impossible to overstress the importance of careful and thorough inspection of drive unit parts prior to reassembly. Thorough visual inspection for indications of wear, and the replacement of such parts as are necessary will eliminate costly and avoidable drive unit failure. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if worn or damaged. Inspect gears for wear or damage. Gears which are scored, pitted, ridged or worn must be replaced. Hex nuts and bolts with rounded corners, all lockwashers, oil seals and gaskets should be replaced at the time of overhaul. Use only genuine Hein-Werner replacement parts for satisfactory service. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. Studs must be tight prior to reassembling the parts.

Reassembly of Gear Boxes (see figure 19)

Reassembly of gear boxes is essentially the reverse of disassembly. When assembling component parts use a press where possible. Tighten all nuts and bolts to the

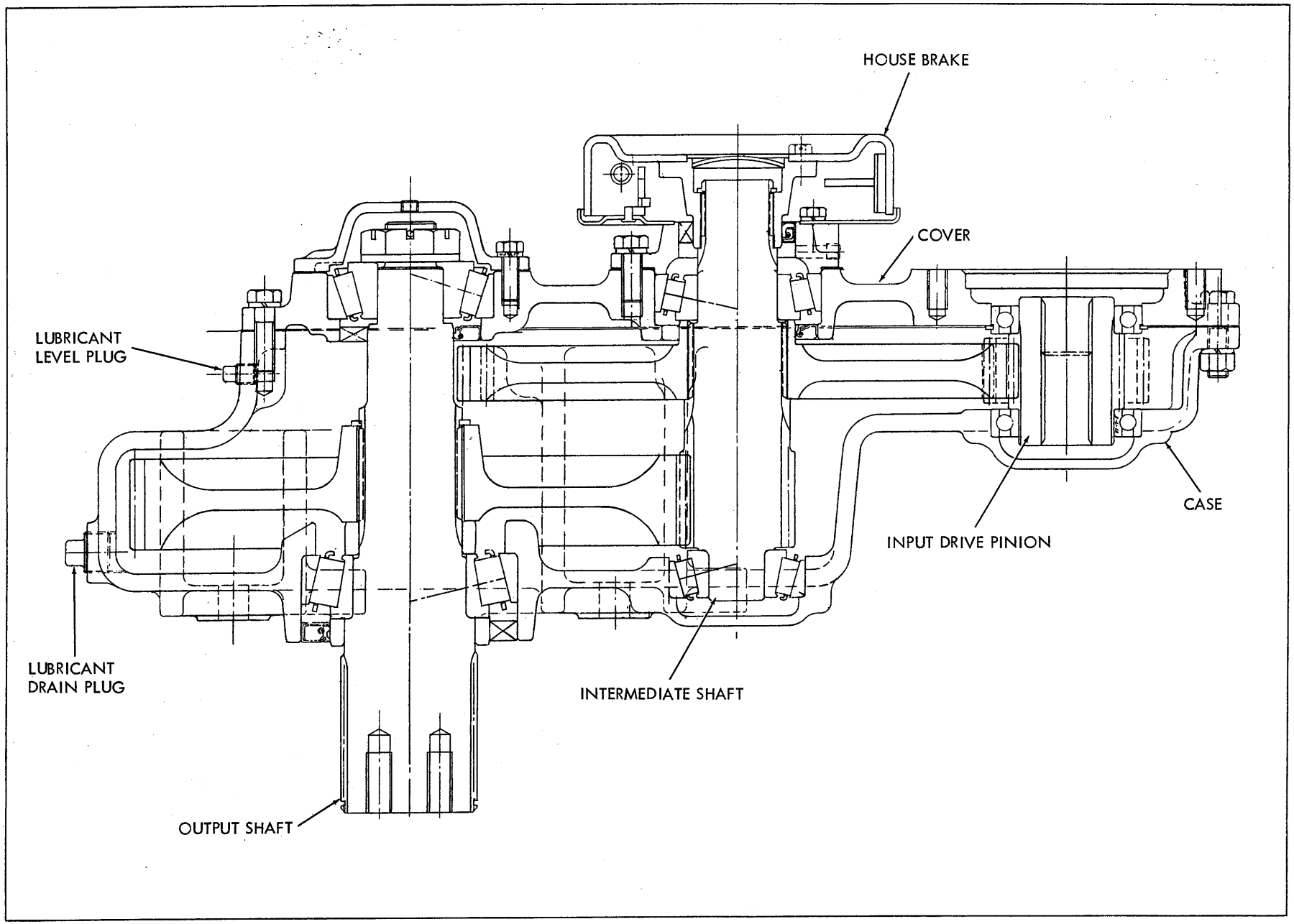

Figure 19. Cross-Sectional View of Gear Box

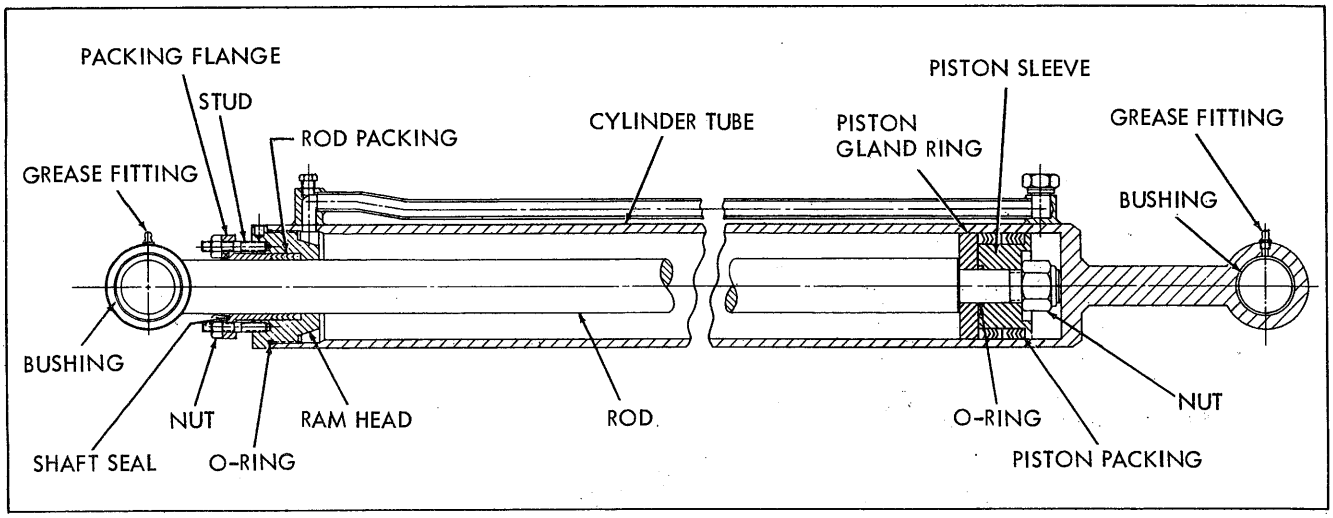

Figure 20. Cross-Sectional View of Hydraulic Cylinder

correct torque as specified in the gear box torque chart. Use soft iron safety wire when replacing pinion to output shaft. Intermediate shaft bearings are adjusted by means of shims under the intermediate shaft cover. Use shims as required for 0.002 inch end play to 0.002 inch preload. Output shaft bearings are adjusted by positioning the nut on the upper end of the output shaft. Position and secure the nut as required for 0.002 inch end play to 0.002 inch preload. Install oil seals, spacers, etc., as illustrated. Pack grease cavity of output and intermediate shaft covers with Mobil No. 5 grease, or equivalent.

Gear Box Torque Chart

Description	Torque
Motor Mounting Nuts (4)	106 to 113 ft. lbs.
Intermediate Shaft Cover Bolts (6)	106 to 113 ft. lbs
Output Shaft Cover Bolts (5)	69 to 73 ft. lbs.
Cover to Case Bolts and Nuts (5)	118 to 128 ft. lbs.
Cover to Case Bolts (14)	106 to 113 ft. lbs.

Replacement of Gear Boxes

Replacement of gear boxes is essentially the reverse of removal. The swing gear box does not require any positioning adjustment. Refer to PROPEL DRIVE CHAIN ADJUSTMENT for proper positioning of the propel gear box. Refer to lubrication specifications and fill both gear boxes to the oil level plug. Inspect carefully for any leaks and tighten connections or replace hoses or fittings as required.

HYDRAULIC CYLINDER SERVICE

Cylinder repair kits consist of ram head and piston sleeve O-rings, rod packings and wiper, piston packing, and rod nut. All parts of the repair kit should be used when a cylinder is repaired, even though some of the parts being replaced may not appear to be worn. It is not necessary to remove a cylinder assembly from the unit in order to repair it with a cylinder repair kit, but extreme care must be taken to prevent the entry of any dirt or foreign particles into the cylinder. Proceed as follows to service a cylinder: (See figures 20 and 21.)

NOTE

Use only factory approved parts to assure proper fit.

1. Extend the bucket and dipstick completely and lower the boom until the bucket is resting firmly on the ground.
2. Remove mounting pin from rod end.
3. Use the spanner wrench supplied in the tool kit to remove the cylinder ram head.
4. Use a hoist or jack to pivot the cylinder to allow clearance for removal of the cylinder rod and piston assembly.
5. Remove hoses from base end of cylinder to release any suction. Remove rod assembly from cylinder tube.
6. Disassemble the cylinder rod and piston assembly as indicated by figure 21. Replace packings, O-rings, wiper seal, and rod nut. Lubricate all parts with hydraulic oil. Reassemble the cylinder rod and piston assembly.
7. Replace the cylinder rod and piston assembly in the cylinder and screw the ram head into the end of the cylinder until it is tight. Replace hoses.

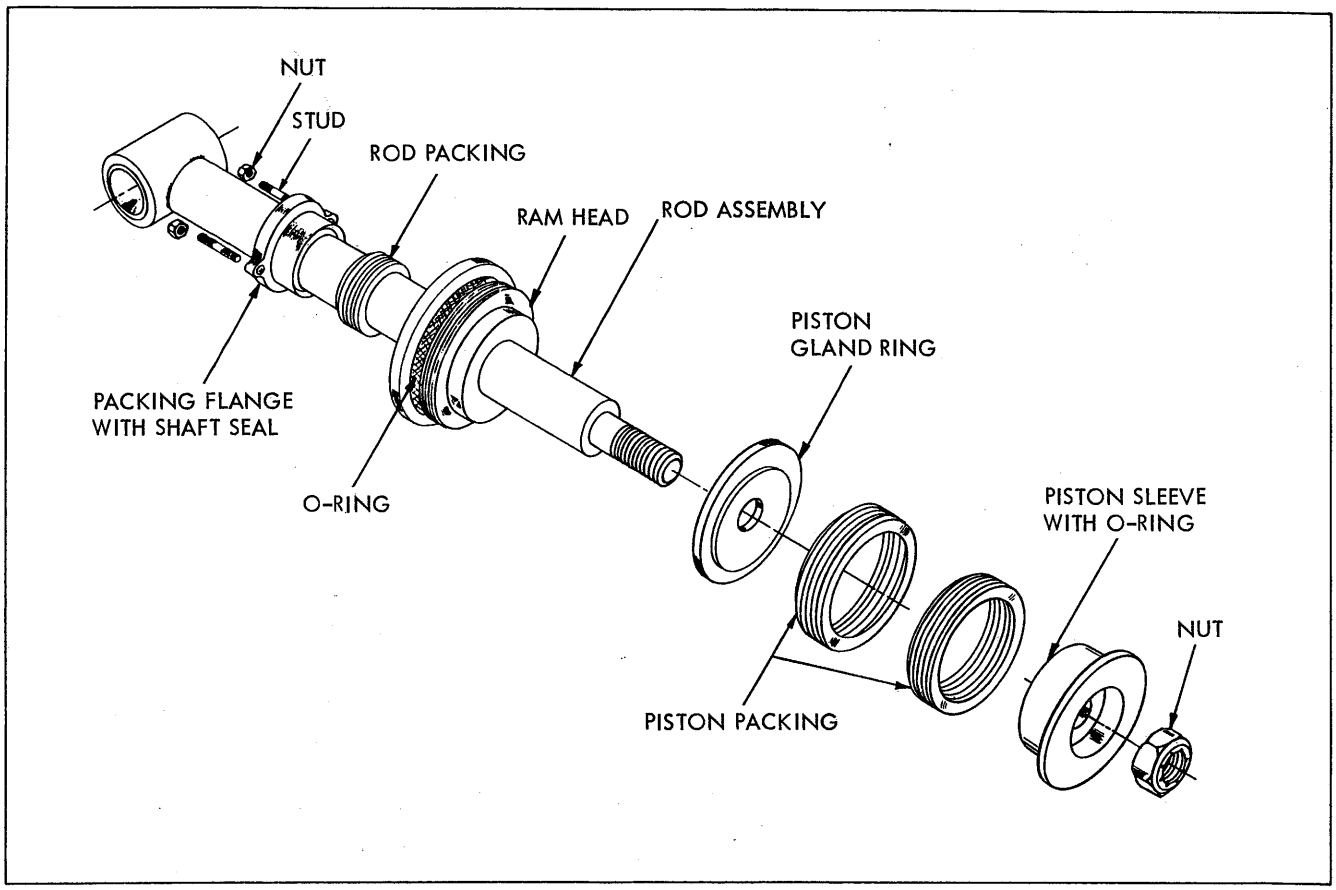

Figure 21. Exploded View of Cylinder Rod Packing Piston Assembly

8. Use a hoist or jack to slowly pivot the cylinder into position. Use control lever to apply slight hydraulic pressure to carefully align the rod end with the cylinder rod end pivot point.

9. Use a plastic hammer to insert the pivot pin. Lock the pivot pin in place.

10. Use the control levers to raise boom and slowly apply hydraulic pressure alternately to both ends of the repaired cylinder until the cylinder is completely filled with oil.

NOTE

After 4 to 8 hours of operation with a cylinder which has been repacked, cylinder packing flanges must be tightened to prevent excessive escape of hydraulic oil around the cylinder rods. Do not overtighten as a small seepage of oil at these points is necessary for cylinder rod lubrication.

REPLACEMENT OF PIVOT PINS

To allow removal of the pins, the bucket and dipstick must be completely extended and the boom lowered until the bucket is resting firmly on the ground. Use hoists or jacks if necessary to support the boom or dipstick if supporting pivot pins are to be removed and replaced. Use a plastic or brass hammer to remove the pins. When replacing a pin, carefully examine the pin bushings for evidence of wear or damage and replace these as necessary. Bushings are a press fit and must be pressed out and in to prevent damage and assure proper fit and operating clearance.

HOUSE BRAKE CYLINDER SERVICE

WARNING

The brake cylinder contains springs under compression and is not to be serviced other than to replace the "V" packing set.

To remove the "V" packing set, unscrew the bronze packing nut and remove packing set. Caution must be used not to damage the cylinder rod. To replace the "V" packing set, carefully slide the packing set over the cylinder rod in the order shown in figure 22.

Replace the packing nut and tighten only enough to seal. A slight seepage of oil is necessary to lubricate cylinder rod.

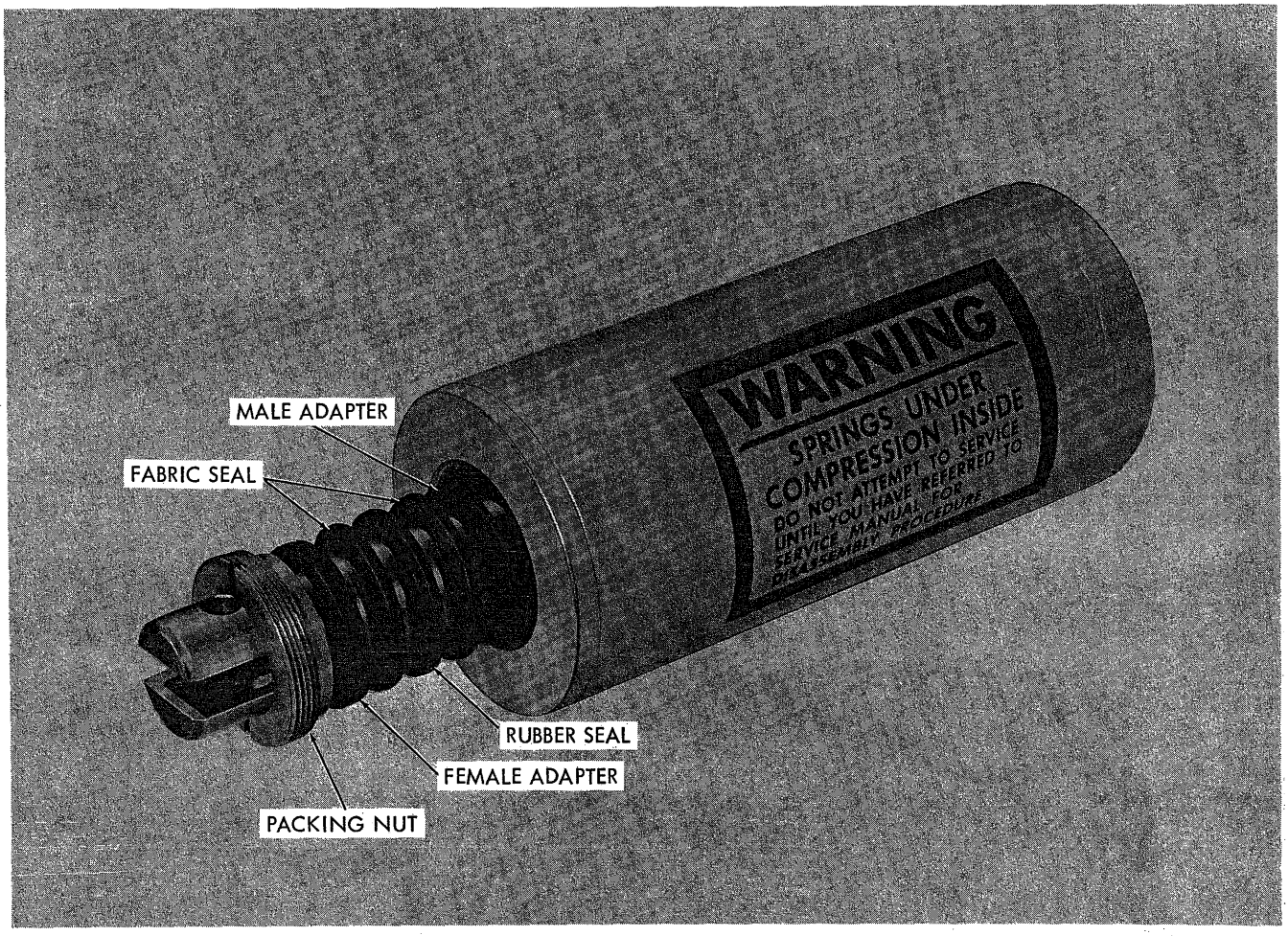

Figure 22. House Brake Cylinder Packing Replacement

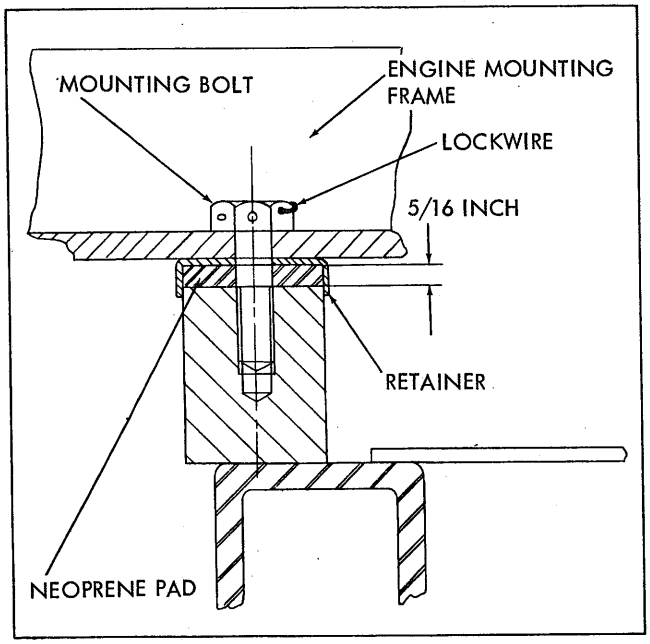

Figure 23. Replacement of Engine Mounting Frames

If the cylinder does not operate for some reason other than packing failure, the entire cylinder must be replaced. Any disassembly, other than that required to replace the packings, is extremely dangerous due to the compressed internal springs, and must not be attempted.

REPLACEMENT OF ENGINE MOUNTING FRAMES

To replace front and rear engine mounting frames, proceed as follows (see figure 23):

1. Tighten the two drilled head bolts on each of three corners to compress the neoprene pad to 5/16 inch.

2. On the fourth corner, turn the two drilled head mounting bolts down until snug, and then tighten 1/8 turn.

3. On each of the four corners, lockwire the two drilled head mounting bolts to each other.

SECTION VI
REPAIR PARTS LIST

All six digit numbers appearing in this parts list are Hein-Werner part numbers. All other part numbers appearing in this parts list are numbers assigned by manufacturers who supply parts to Hein-Werner. When ordering such a manufacturer's part, be sure to indicate, in addition to the part number, the name of the part and the assembly in which it is contained.

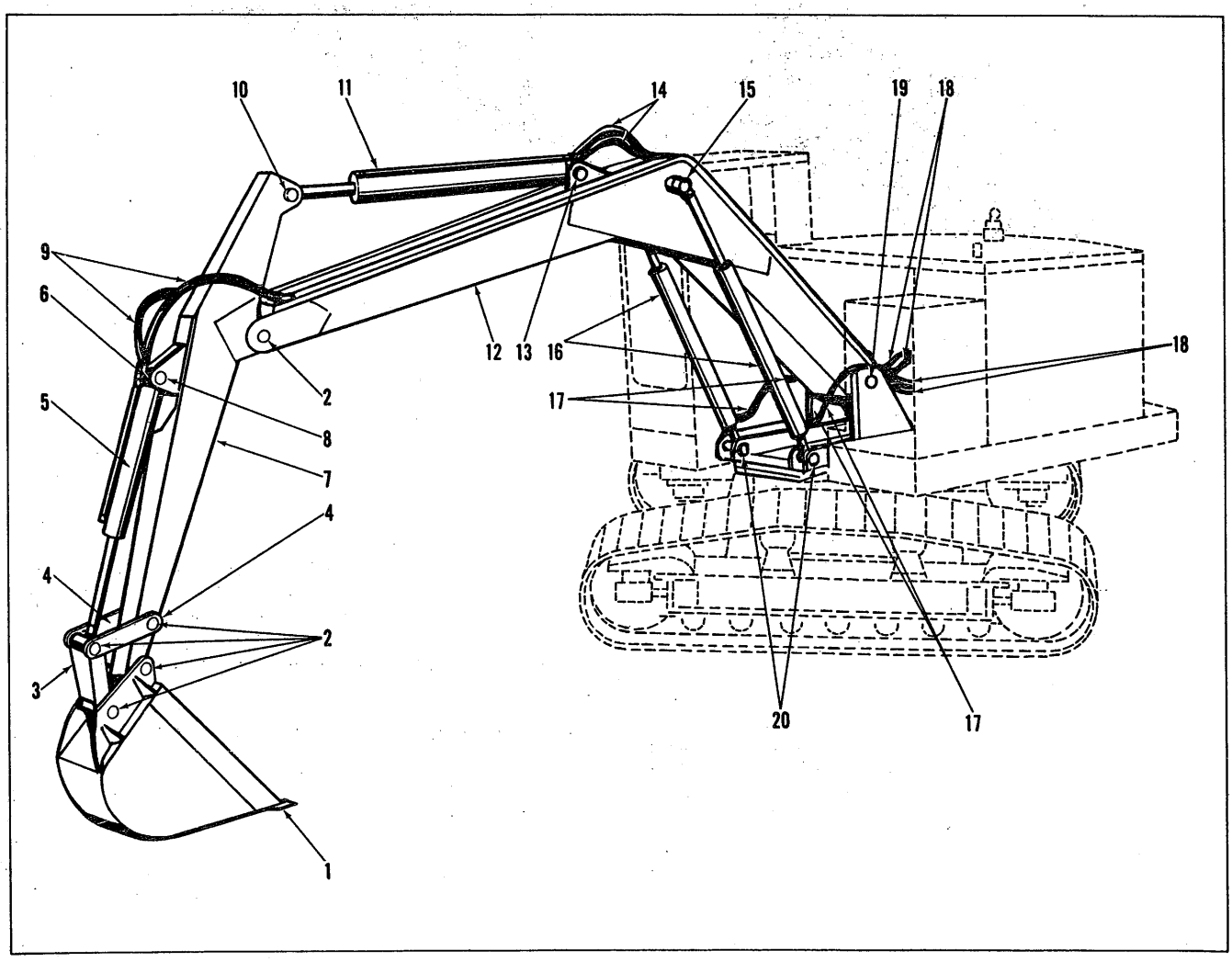

Figure 24. Boom, Bucket, and Dipstick

Index Number	Part Number	Description	Quantity
1	400033	Bucket Tooth Point	as reqd
	400034	Bucket Tooth Shank	as reqd
	400035	Bucket Tooth Pin	as reqd

Index Number	Part Number	Description	Quantity
		BOOM, BUCKET, AND DIPSTICK (CONT)	
2	210024	Bucket and Linkage Pin	5
3	150003	Bucket Link Assembly	1
4	140027	Bell Crank Link Assembly	2
	220028	Bell Crank Bushing - Not Grooved	2
	220027	Bell Crank Bushing - Grooved	2
5	040049	Bucket Cylinder Assembly	1
6	400018	Lock Pin	14
	400026	Cotter Pin	14
7	110045	Dipstick (C-10)	1
	110045	Dipstick (C-10HD)	1
	110052	Dipstick (C-12)	1
	220028	Dipstick Pivot Bushing	6
8	210002	Bucket Cylinder Base Pin	1
9	030039	Bucket Cylinder Hose (C-10)	2
	030039	Bucket Cylinder Hose (C-10HD)	2
	030166	Bucket Cylinder Hose (C-12)	2
10	210002	Dipstick Rod Pin	1
11	040050	Dipstick Cylinder	1
12	100053	Boom Assembly (C-10)	1
	100081	Boom Assembly (C-10HD)	1
	100081	Boom Assembly (C-12)	1
	030022	Boom Tube - Outer	2
	030023	Boom Tube - Inner	2
	030024	Boom Tube - To Bucket Cylinder Hose (C-10)	2
	030162	Boom Tube - To Bucket Cylinder Hose (C-10HD)	2
	030162	Boom Tube - To Bucket Cylinder Hose (C-12)	2
	400254	Boom Double Tube Clamps (Top and Bottom)	6
	400043	Boom Single Tube Clamps	6
	220000	Boom and Dipstick Pivot Bushing	8
13	210028	Dipstick Cylinder Base Pin	1
14	030036	Dipstick Cylinder Hose (C-10)	2
	030164	Dipstick Cylinder Hose (C-10HD)	2
	030164	Dipstick Cylinder Hose (C-12)	2
15	210003	Boom Lift Pin	1
	210004	Boom Lift Pin Collar	1
16	040051	Boom Cylinder Assembly (C-10)	2
	040059	Boom Cylinder Assembly (C-10HD)	2
	040059	Boom Cylinder Assembly (C-12)	2
17	030038	Boom Cylinder Hose	4
18	030036	Boom Foot Hose	4
19	210027	Boom Foot Pin	1
20	210002	Boom Cylinder Base Pin	2
	400015	Grease Fitting	9

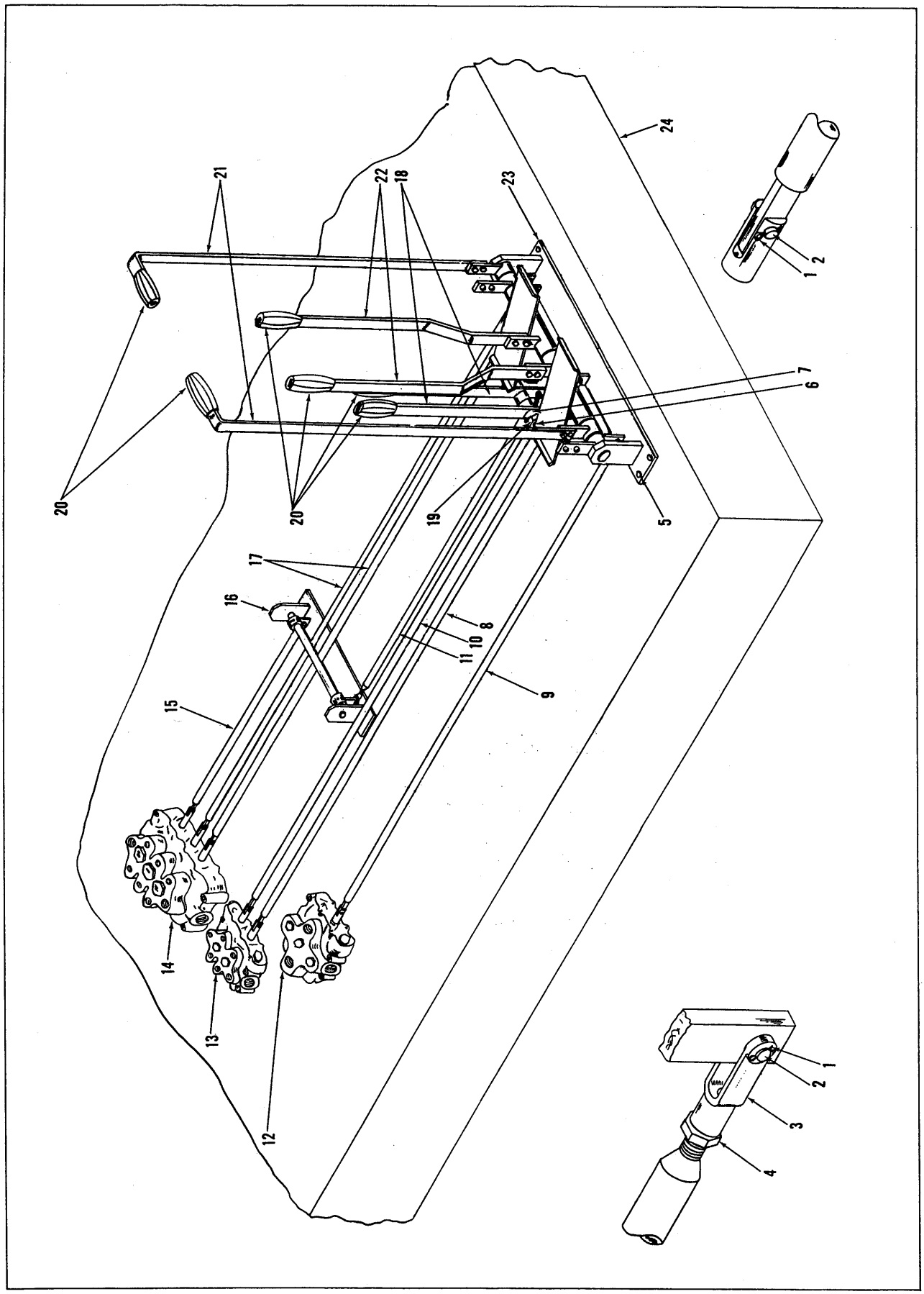

Figure 25. Machinery Platform With Controls

Index Number	Part Number	Description	Quantity
		MACHINERY PLATFORM WITH CONTROLS	
1	400027	Cotter Pin	14
2	400024	Yoke Pin	14
3	400122	Yoke	8
4	400121	Nut	8
5	400106	Bolt	20
	400023	Washer	20
	400048	Nut	20
6	330024	Shaft	1
7	330023	Spacer	2
8	330076	Control Rod	1
9	330077	Control Rod	1
10	330078	Control Rod	1
11	330080	Control Rod	1
12	000011	Control Valve - Single Spool	1
13	000013	Control Valve - Two Spool	1
14	000012	Control Valve - Three Spool	1
15	330079	Control Rod	1
16	330068	Control Shaft Assembly	1
17	330075	Control Rod	2
18	330059	Travel Lever	2
19	330028	Base	1
	400006	Setscrew	2
20	120039	Handle Grip	6
21	330042	Boom and Swing Lever	2
22	330070	Bucket and Dipstick Lever	2
23	330017	Control Base Assembly	1
24	120169	Machinery Platform	1
	400005	Grease Fitting	8

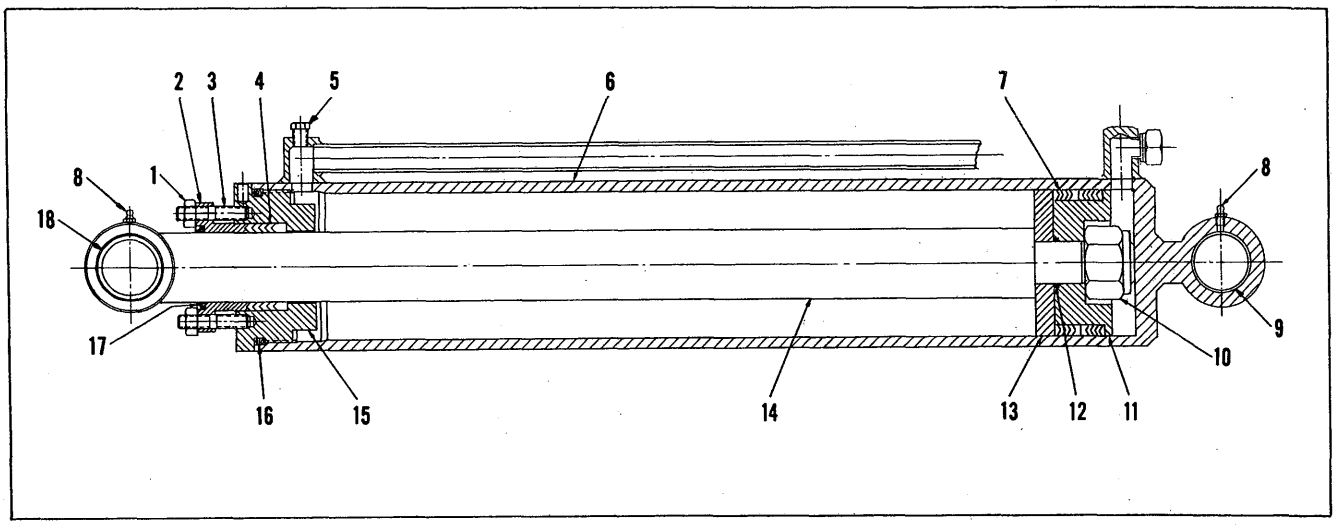

Figure 26. Bucket Cylinder Assembly (040049)

Index Number	Part Number	Description	Quantity
1	400013	Nut	2
2	040015	Packing Flange	1
3	400001	Stud	2
4	010002	Rod Packing Set	1
5	020101	Pipe Plug	1
6	040041	Cylinder Tube	1
7	010006	Piston Packing Set	2
8	400015	Grease Fitting	2

Index Number	Part Number	Description	Quantity
		BUCKET CYLINDER ASSEMBLY (CONT)	
9	220000	Bushing	2
10	400011	Nut	1
11	040023	Piston Sleeve	1
12	010013	O-Ring	1
13	040022	Piston Gland Ring	1
14	040032	Rod	1
15	040005	Ram Head	1
16	010014	O-Ring	1
17	010010	Shaft Seal	1
18	220026	Bushing	2

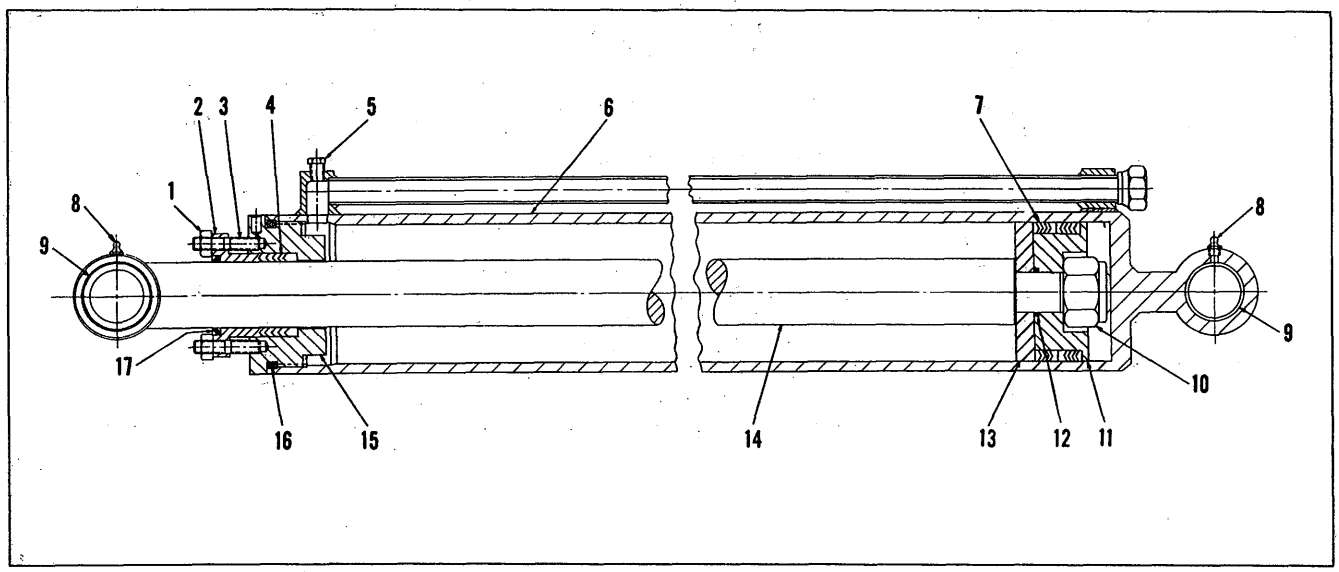

Figure 27. Dipstick Cylinder Assembly (040050)

Index Number	Part Number	Description	Quantity
1	400013	Nut	2
2	040015	Packing Flange	1
3	400001	Stud	2
4	010002	Rod Packing Set	1
5	020101	Pipe Plug	2
6	040044	Cylinder Tube	1
7	010006	Piston Packing Set	2
8	400015	Grease Fitting	2
9	220000	Bushing	4
10	400011	Nut	1
11	040023	Piston Sleeve	1
12	010013	O-Ring	1
13	040022	Piston Gland Ring	1
14	040030	Rod	1
15	040005	Ram Head	1
16	010014	O-Ring	1
17	010010	Shaft Seal	1

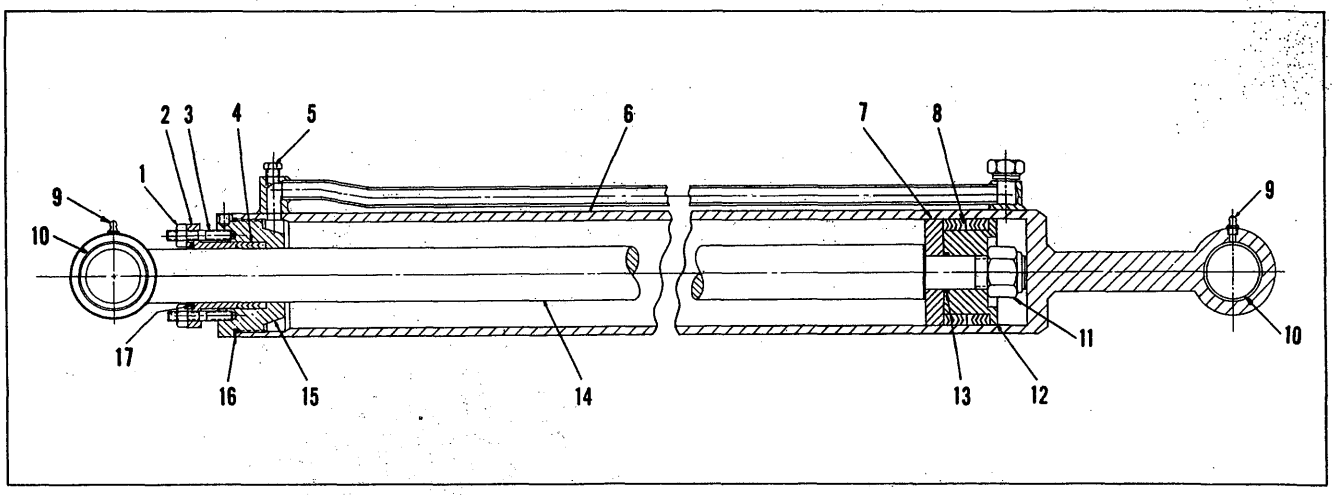

Figure 28. Boom Cylinder Assembly

Index Number	Part Number	Description	Quantity
		BOOM CYLINDER ASSEMBLY - 4 INCH (040051)	
1	400014	Nut	2
2	040014	Packing Flange	1
3	400000	Stud	2
4	010004	Rod Packing Set	1
5	020101	Pipe Plug	1
6	040042	Cylinder Tube	1
7	040024	Piston Gland Ring	1
8	010005	Piston Packing Set	2
9	400015	Grease Fitting	2
10	220000	Bushing	4
11	400012	Nut	1
12	040025	Piston Sleeve	1
13	010011	O-Ring	1
14	040031	Rod	1
15	040006	Ram Head	1
16	010012	O-Ring	1
17	010009	Shaft Seal	1
		BOOM CYLINDER ASSEMBLY - 5-1/4 INCH (040059)	
1	400013	Nut	2
2	040015	Packing Flange	1
3	400001	Stud	2
4	010002	Rod Packing Set	1
5	020101	Pipe Plug	1
6	040063	Cylinder Tube	1
7	040022	Piston Gland Ring	1
8	010006	Piston Packing Set	2
9	400015	Grease Fitting	2
10	220000	Bushing	4
11	400011	Nut	1
12	040023	Piston Sleeve	1
13	010013	O-Ring	1
14	040058	Rod	1
15	040005	Ram Head	1
16	010014	O-Ring	1
17	010010	Shaft Seal	1

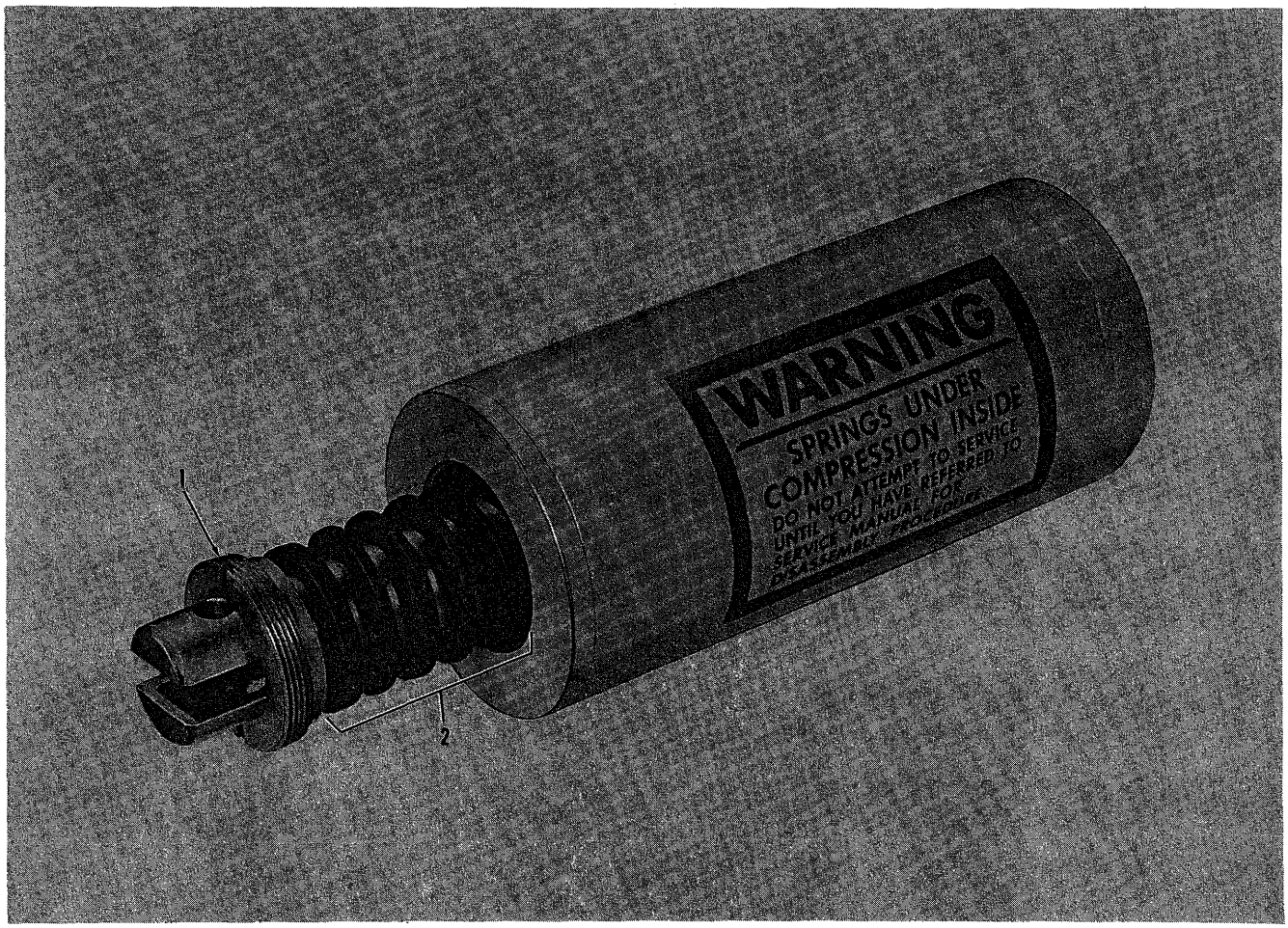

Figure 29. House Brake Cylinder Packing

Index Number	Part Number	Description	Quantity
1	230068	Rod Packing Nut	1
2	010024	Packing Set	1

Index Number	Part Number	Description	Quantity
		HOUSE BRAKE INSTALLATION	
1	400208	Clevis Pin	1
2	230064	Brake Cylinder	1
3	400207	Clevis Pin	2
4	400099	Cotter Pin	3
5	230062	Cylinder Support	1
6	400210	Cap Screw	2
7	230051	Brake Lever Assembly	1

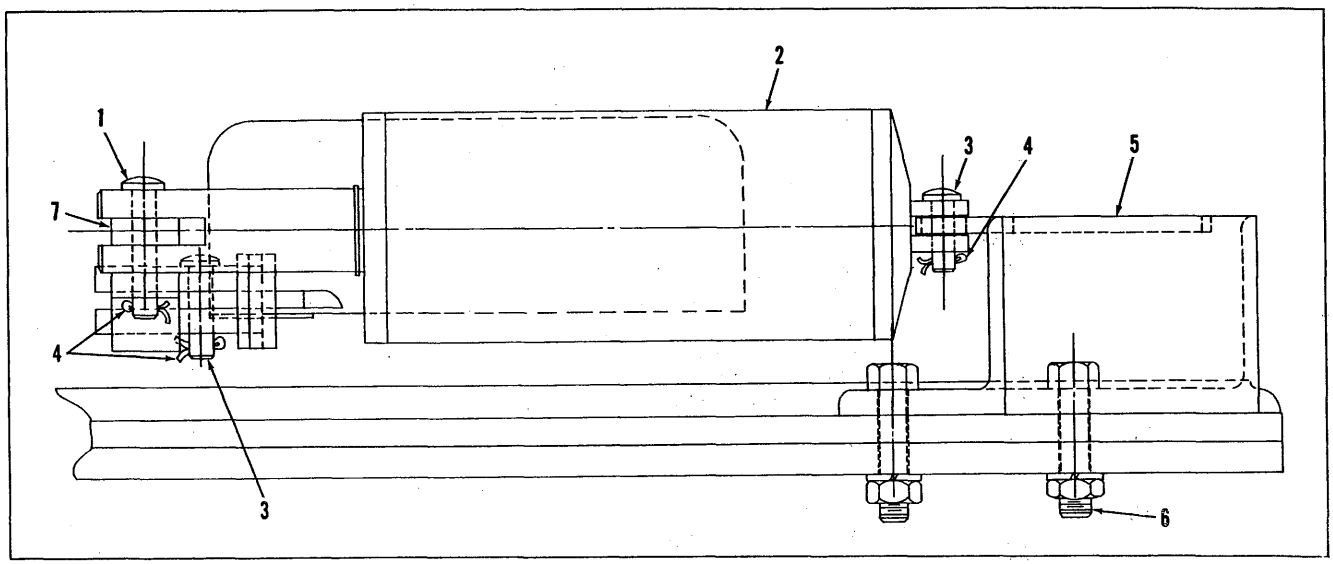

Figure 30. House Brake Installation

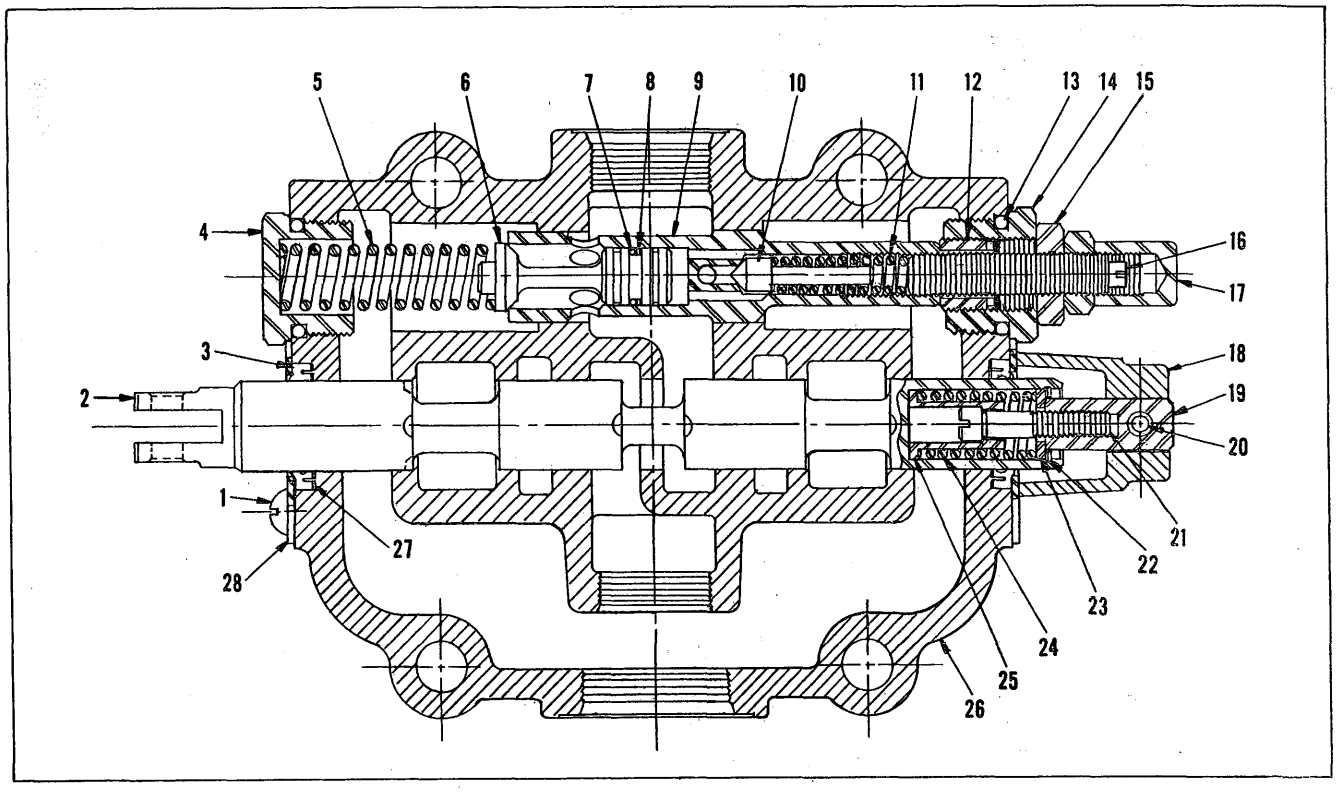

Figure 31. Swing Control Valve Assembly (000011)

Index Number	Part Number	Description	Quantity
1	3783	Round Head Machine Screw	2
2	3187	Plunger - Double Acting.	*1
3	3237	Oil Seal and Wiper.	2
	3246	Check Valve Plug	1
	3247	Check Valve Spring	1

Index Number	Part Number	Description	Quantity
		SWING CONTROL VALVE ASSEMBLY (CONT)	
3	3248	Check Valve Poppet	1
	3273	Cap Screw	2
	3393	Plug	2
	3394	O-Ring	2
4	3239	Relief Valve Plug	1
5	3232	Relief Valve Spring	1
6	3234	Relief Valve Poppet	1
7	139	O-Ring	1
8	3128	Back-Up Ring	1
9	3233	Relief Valve Sleeve	1
10	3287	Poppet	1
11	3231	Relief Valve Pilot Spring	1
12	3235	Relief Valve Adjust Screw	1
13	3028	O-Ring	3
14	3238	Relief Valve Pilot Plug	1
15	3236	Nut	1
16	3240	Adjust Screw	1
17	3013	Castle Nut	1
18	3275	Plunger Cap	1
19	3242	Plunger Pin - Female	1
20	3245	Drive Pin	1
21	3241	Cap Screw - Special	1
22	3244	Snap Ring	1
23	3243	Stop Washer	1
24	3271	Plunger Spring	1
25	3249	Plunger Sleeve	1
26	3211-7	Valve Housing	*1
27	3138	Seal Ring	2
28	3141	Seal Plate	2

* The above parts should not be considered for field replacement.

Index Number	Part Number	Description	Quantity
		DIPSTICK AND PROPEL CONTROL VALVE ASSEMBLY	
1	3783	Round Head Machine Screw	4
2	3237	Wiper Seal	4
3	3187	Plunger - Double Acting	*2
4	3239	Relief Valve Plug	1
5	3028	O-Ring	4
6	3232	Relief Valve Spring	1
7	3234	Relief Valve Poppet	1
8	3233	Relief Valve Sleeve	1
9	139	O-Ring	1
10	3128	Back-Up Ring	1
11	3087	Pilot Relief Poppet	1
12	3231	Relief Valve Pilot Spring	1
13	3235	Relief Valve Adjust Screw	1
14	3238	Relief Valve Pilot Plug	1
15	3236	Nut	1
16	3240	Adjust Screw	1
17	3013	Castle Nut	1
18	3275	Plunger Cap	2
19	3245	Pin	2
20	3242	Plunger Pin	2

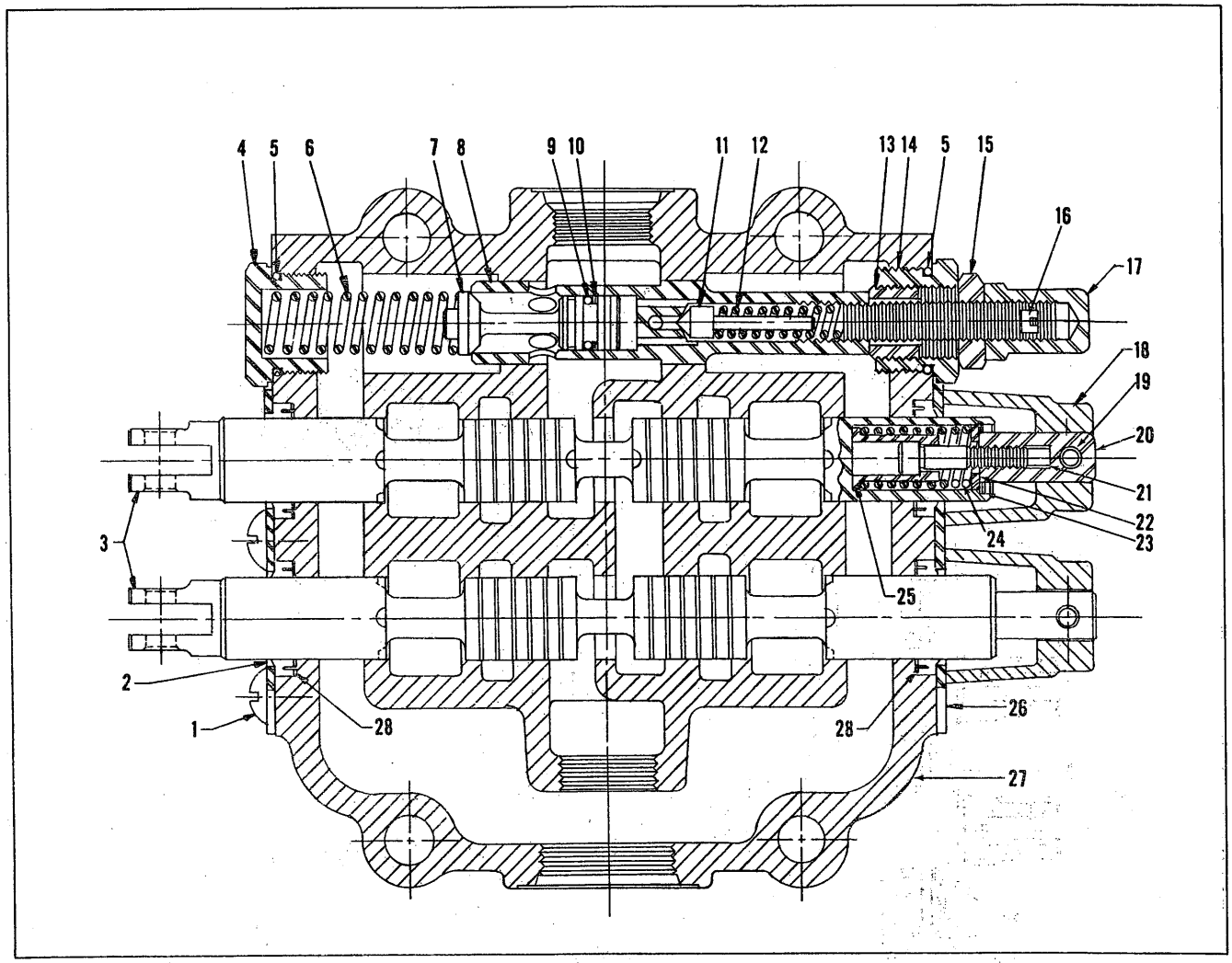

Figure 32. Dipstick and Propel Valve Assembly (000013)

Index Number	Part Number	Description	Quantity
21	3241	Cap Screw - Special	2
22	3243	Washer	2
23	3244	Snap Ring	2
24	3271	Plunger Spring	2
25	3249	Plunger Sleeve	2
26	3141	Seal Plate	4
27	3262-1	Valve Housing	*1
28	3138	Seal Ring	4
	3246	Check Valve Plug	2
	3247	Check Valve Spring	2
	3248	Check Valve Poppet	2
	3273	Socket Head Cap Screw	4
	3285	O-Ring	1
	3286	Plug	1

* These parts should not be considered for field replacement.

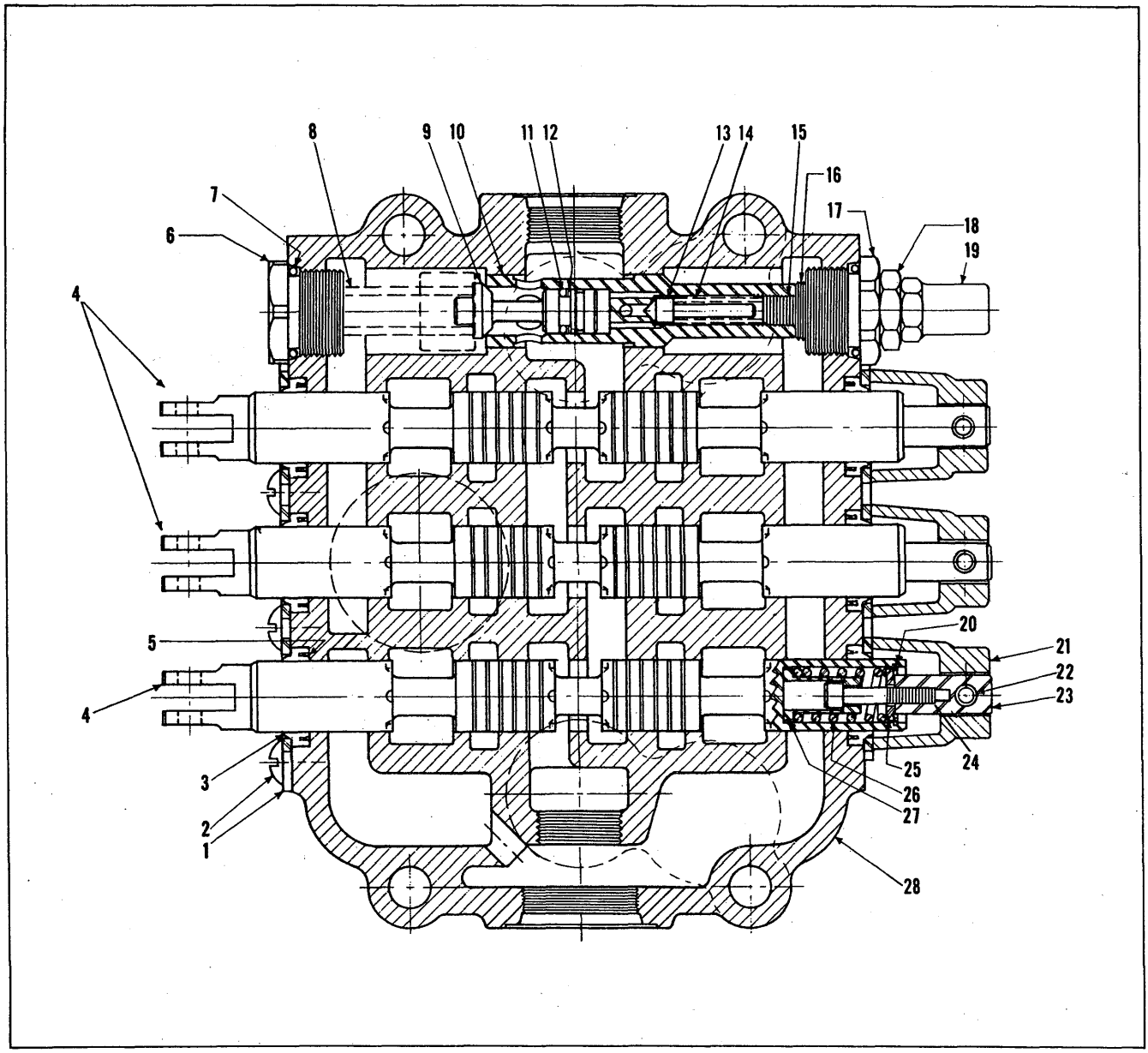

Figure 33. Boom, Bucket, and Propel Control Valve Assembly (000012)

Index Number	Part Number	Description	Quantity
1	3141	Seal Plate	6
2	3783	Round Head Machine Screw	6
3	3486	Wiper Seal	6
4	3187	Plunger - Double Acting	*3
5	4476	Seal Ring	6
6	3239	Relief Valve Plug	1
7	3028	O-Ring	6
8	3232	Relief Valve Spring	1
9	3234	Relief Valve Poppet	1
10	3233	Relief Valve Sleeve	1

Index Number	Part Number	Description	Quantity
		BOOM, BUCKET, AND PROPEL CONTROL VALVE ASSEMBLY (CONT)	
11	139	O-Ring	1
12	3128	Back-Up Ring	1
13	3087	Pilot Relief Poppet	1
14	3231	Relief Valve Pilot Spring	1
15	3240	Adjust Screw	1
16	3235	Relief Valve Adjust Screw	1
17	3238	Relief Valve Pilot Plug	1
18	3236	Nut	1
19	3013	Castle Nut	1
20	3244	Snap Ring	3
21	3275	Plunger Cap	3
22	3245	Drive Pin	3
23	3242	Plunger Pin - Female	3
24	3241	Cap Screw - Special	3
25	3243	Stop Washer	3
26	3271	Plunger Spring	3
27	3249	Plunger Sleeve	3
28	3213-38	Valve Housing	*1
	3246	Check Valve Plug	4
	3248	Check Valve Poppet	4
	3247	Check Valve Spring	4
	3273	Cap Screw	6

* These parts should not be considered for field replacement.

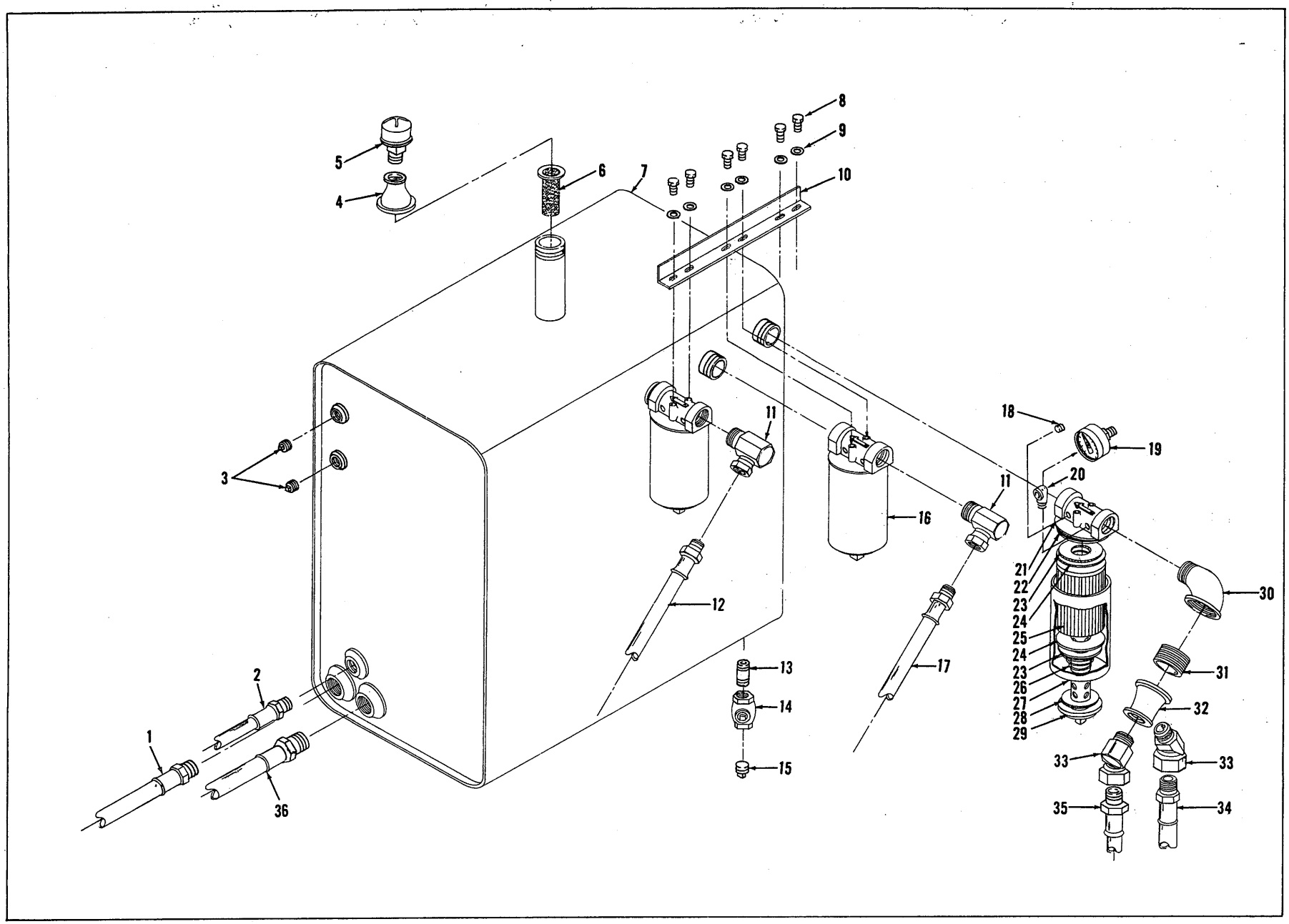

Figure 34. Hydraulic Reservoir and Filters

Index Number	Part Number	Description	Quantity
		HYDRAULIC RESERVOIR AND FILTERS	
1	030179	Hose	1
2	030177	Hose	1
3	020101	Plug	2
4	020151	Reducer	1
5	240013	Breather Cap	1
6	400251	Screen	1
7	050006	Reservoir	1
8	400222	Cap Screw	6
9	400223	Washer	6
10	120218	Angle	1
	400228	Pump Supply Lines Hose Clamp	4
11	020155	Adapter Elbow	2
12	030176	Hose	1
13	030182	Nipple	1
14	000019	Drain Valve	1
	400200	Drain Valve Handle	1
15	020105	Pipe Plug	1
16	050007	Filter Assembly	3
17	030178	Hose	1
18	015	Plug	3
19	1568	Backpressure Gage	3
20	020163	Street Ell	3
21	1560	Head	1
22	1576	O-Ring	1
23	1564	Backup Washer	2
24	1565	Gasket	2
25	1566	Element - Cleanable	1
	1567	Element - Disposable	1
26	1563	Spring	1
27	1562	Housing	1
28	1575	Center Post Seal	1
29	1561	Center Post	1
30	020152	Street Ell	1
31	020110	Close Nipple	1
32	020153	Reducer Tee	1
33	020154	Adapter Union	2
34	030175	Hose	1
35	030174	Hose	1
36	030180	Hose	1

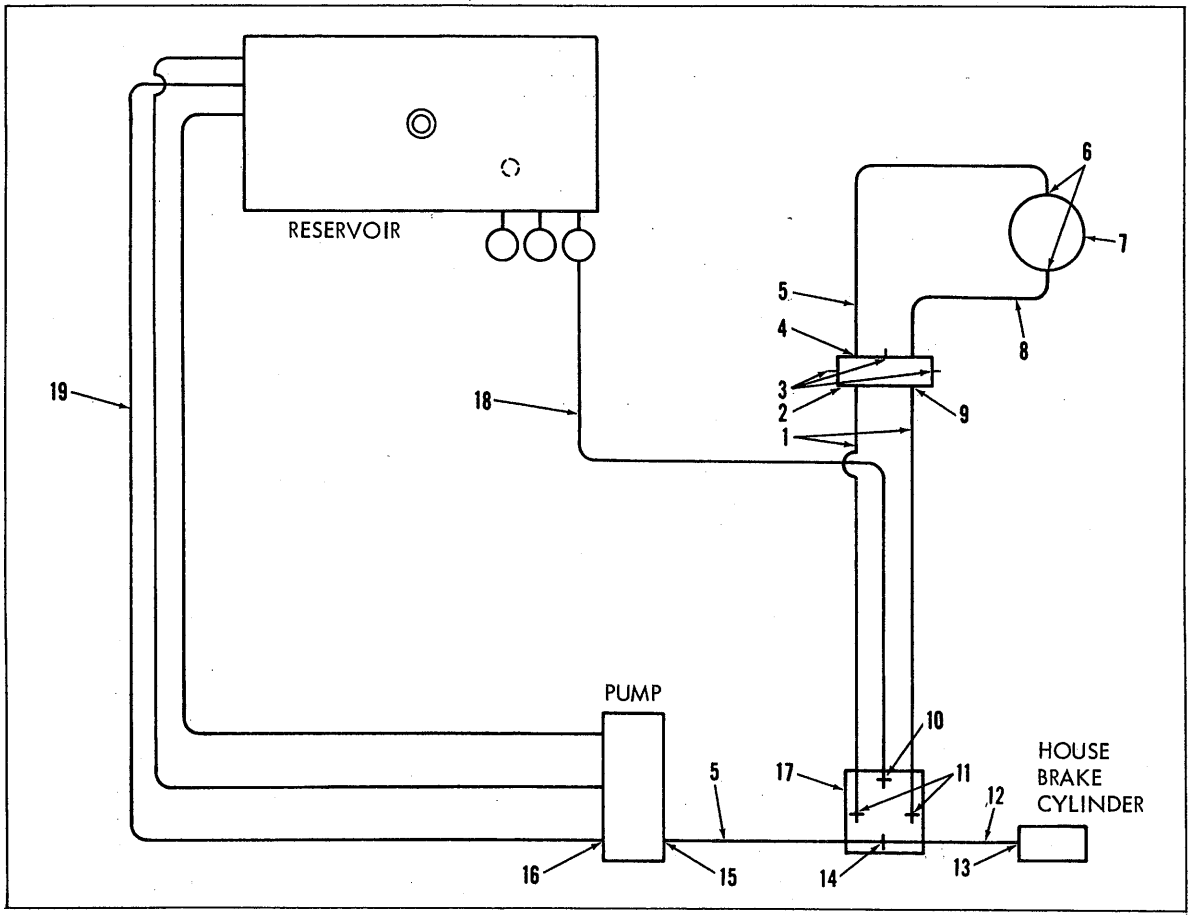

Figure 35. Swing Circuit Hydraulic System

Index Number	Part Number	Description	Quantity
1	030141	Tube	2
2	000005	Crossover Relief Valve	1
3	020003	Pipe Plug	3
4	020000	Union	2
5	030036	Hose	2
6	020013	Adapter Elbow	2
7	000016	Swing Motor	1
8	030035	Hose	1
9	020125	Connector	2
10	020023	Pipe Plug	1
	020160	Elbow	1
11	020122	Connector	2
12	030181	Hose	1
13	020162	Adapter	1
14	020130	Adapter Tee	1
15	020150	Adapter	1
16	020148	Elbow	1
17	000011	Control Valve	1
	400042	Tube Clamp - 7/8 inch	2
	400041	Tube Clamp - 5/8 inch	1
18	030174	Hose	1
19	030177	Hose	1

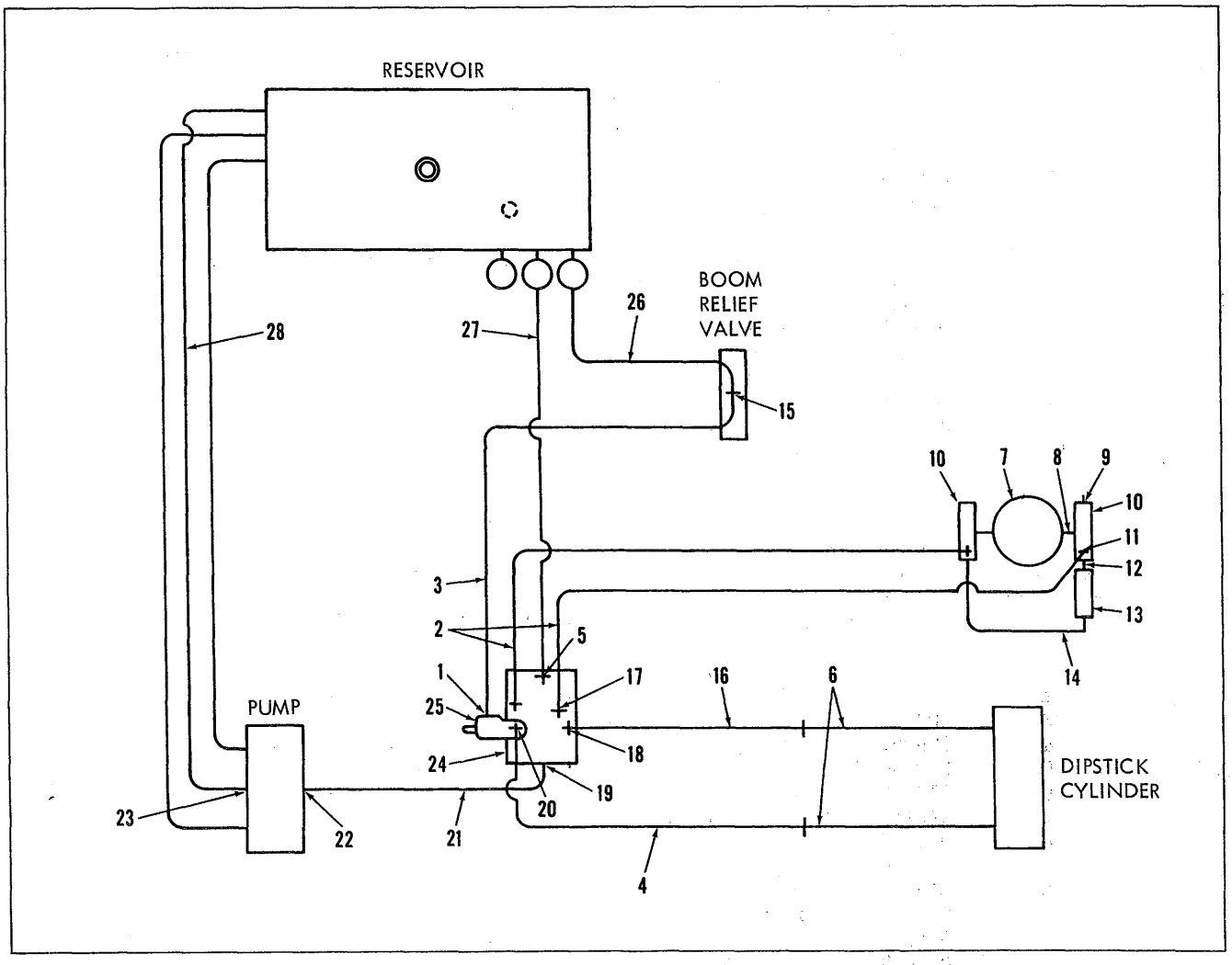

Figure 36. Dipstick and Propel Circuit Hydraulic System

Index Number	Part Number	Description	Quantity
1	020124	Connector	1
2	030161	Hose	2
3	030140	Tube	1
4	030124	Tube	1
5	020023	Plug	1
	020157	Elbow	1
6	030036	Hose	2
7	000017	Propel Motor	1
8	020161	Nipple	2
9	020003	Pipe Plug	2
10	020106	Manifold	2
11	020144	Adapter Elbow	2
12	020112	Nipple	1
13	000005	Crossover Relief Valve	1
	020003	Pipe Plug	5
14	030129	Hose	1
15	020121	Connector Tee	1
16	030125	Tube	1
17	020143	Connector Elbow	2
18	020122	Connector	1
19	020132	Adapter Elbow	1

Index Number	Part Number	Description	Quantity
		DIPSTICK AND PROPEL CIRCUIT HYDRAULIC SYSTEM (CONT)	
20	020009	Connector	1
21	030127	Hose	1
22	020149	Adapter	1
23	020147	Elbow	1
24	000013	Control Valve	1
	400044	Tube Clamp - One Inch Double Open	20
25	000004	Relief Valve	1
	020126	Adapter	1
	020125	Connector	1
	010019	O-Ring	1
26	030175	Hose	1
27	030178	Hose	1
28	030179	Hose	1

Index Number	Part Number	Description	Quantity
		BOOM, BUCKET, AND PROPEL CIRCUIT HYDRAULIC SYSTEM	
1	030160	Hose	2
2	020144	Elbow	2
3	000017	Propel Motor	1
4	030002	Tube	1
5	030006	Tube	1
6	020143	Elbow	2
7	020159	Connector	1
8	030007	Tube	1
9	030038	Hose	4
10	020113	Elbow	1
11	030010	Tube	2
12	030036	Hose	2
13	020009	Connector	1
14	030009	Tube	1
15	000004	Relief Valve	1
16	020024	Connector Tee	1
17	030001	Tube	1
18	030008	Tube	1
19	020122	Connector	4
20	020132	Adapter Elbow	1
21	030165	Hose	1
22	020149	Adapter	1
23	020147	Elbow	1
24	000012	Control Valve	1
	400044	Tube Clamp - One Inch Double Open	14
25	030180	Hose	1
26	030176	Hose	1

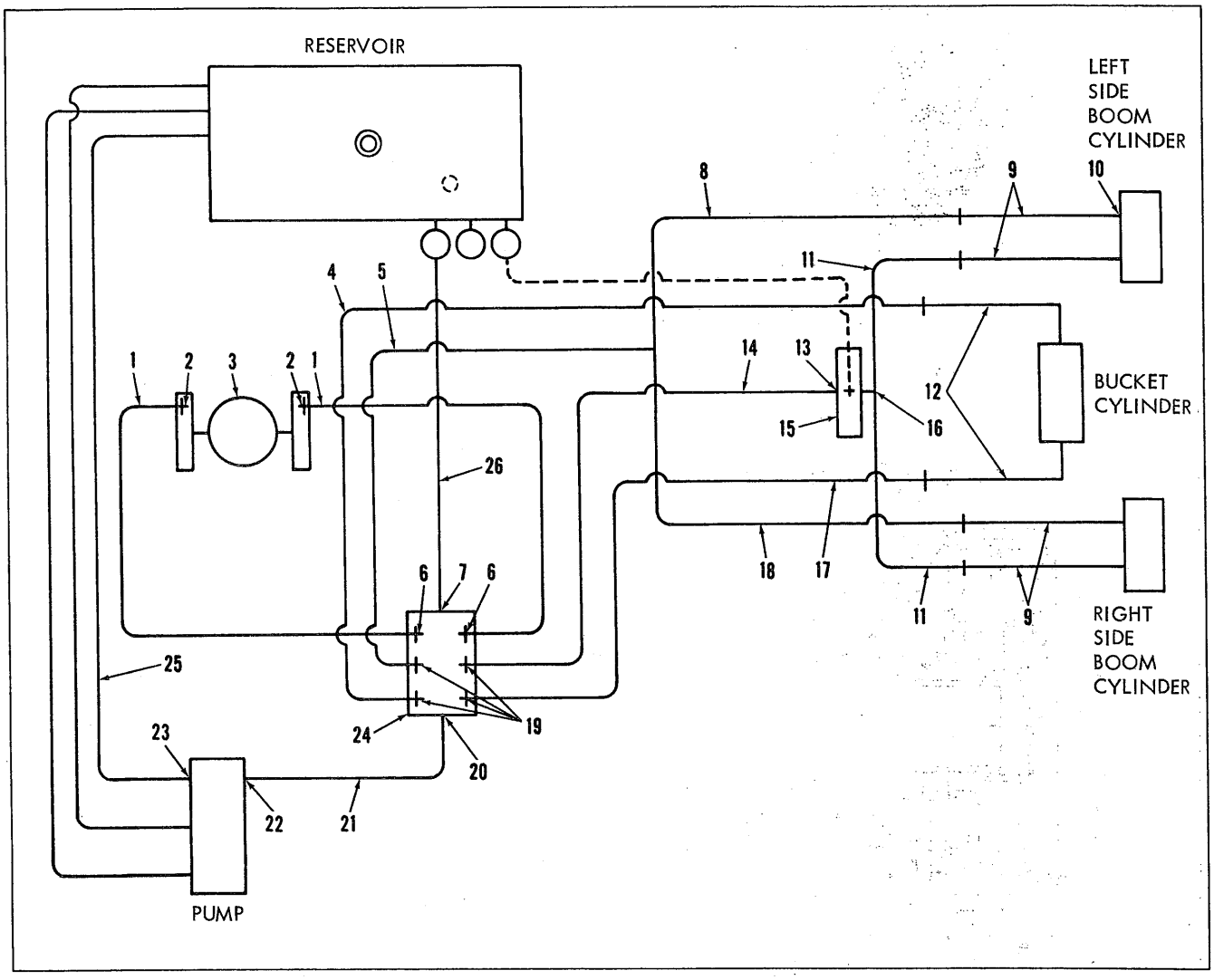

Figure 37. Boom, Bucket, and Propel Circuit Hydraulic System

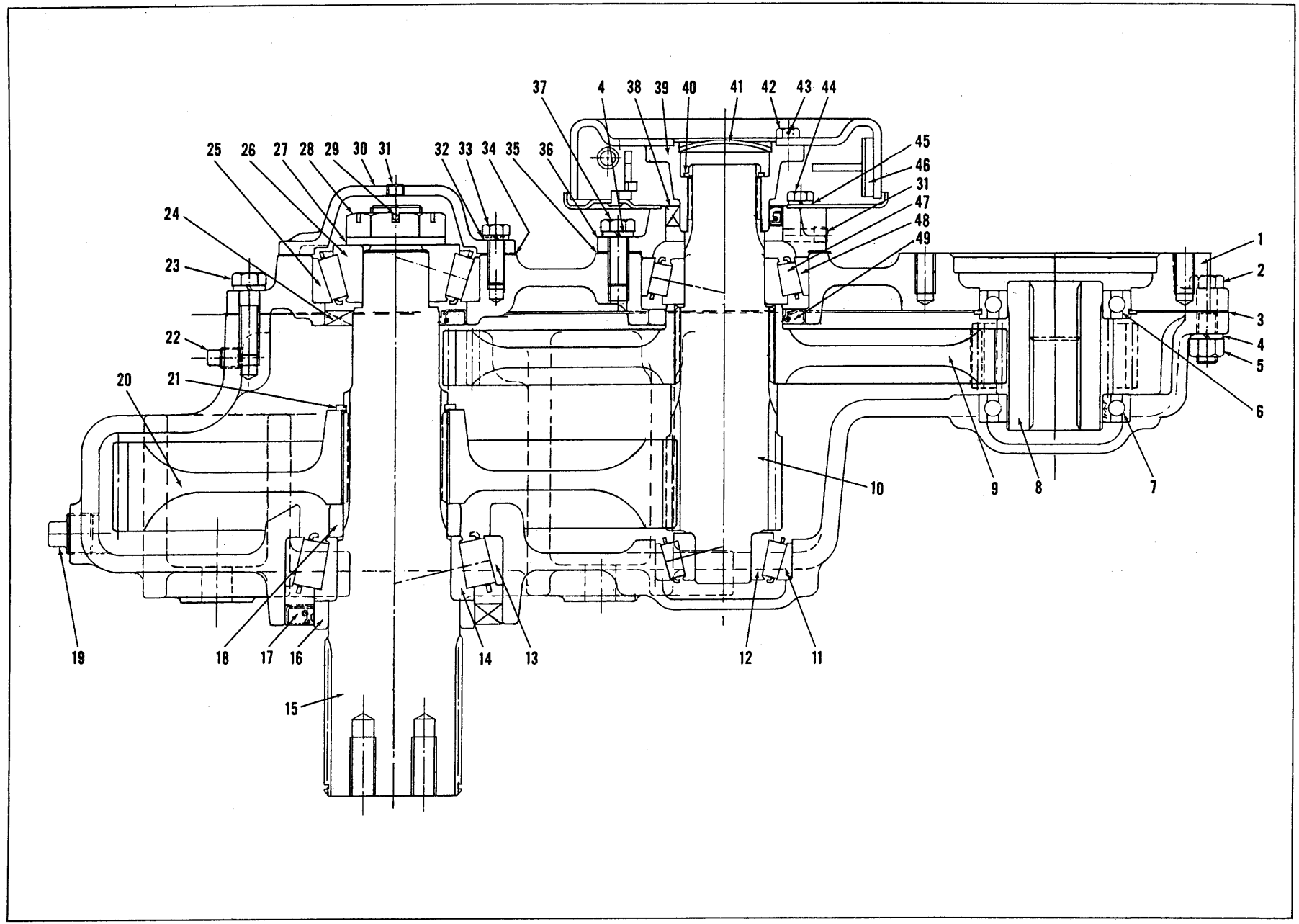

Figure 38. Swing and Propel Gear Boxes

WHEN ORDERING PARTS FOLLOW THE INSTRUCTIONS OUTLINED ON PAGE ii

Index Number	Part Number	Description	Quantity
		SWING AND PROPEL GEAR BOXES (240039 and 240040)	
1	240048	Case and Cover - Matched Set	1
2	400233	Bolt	5
3	240049	Gasket	1
4	400234	Lockwasher	25
5	400235	Nut	5
6	220032	Input Pinion Bearing - Upper (Swing Gear Box)	1
	220033	Input Pinion Bearing - Upper (Propel Gear Box)	1
7	220031	Input Pinion Bearing - Lower	1
8	200016	Input Drive Pinion (21T)	1
9	200017	Intermediate Driven Gear (75T)	1
10	200020	Intermediate Pinion (15T)	1
11	220036	Intermediate Shaft Bearing Cup - Lower	1
12	220041	Intermediate Shaft Bearing Cone - Lower	1
13	220039	Output Shaft Bearing Cup - Lower	1
14	220040	Output Shaft Bearing Cone - Lower	1
15	210066	Output Shaft	1
16	240051	Output Shaft Oil Seal Sleeve	1
17	010031	Output Shaft Oil Seal - Lower	1
18	250052	Output Shaft Gear Spacer	1
19	020188	Drain Plug	1
20	200019	Final Drive Gear (82T)	1
21	400237	Snap Ring	1
22	020187	Oil Level Plug	1
23	400238	Cap Screw	14
24	010029	Output Shaft Oil Seal - Upper	1
25	220038	Output Shaft Bearing Cup - Upper	1
26	220042	Output Shaft Bearing Cone - Upper	1
27	400250	Output Shaft Washer	1
28	400240	Output Shaft Nut	1
29	400241	Cotter Pin	1
30	230079	Output Shaft Cover	1
31	020185	Pipe Plug	2
32	400242	Lockwasher	5
33	400244	Capscrew	5
34	250028	Gasket	1
35	250025	Intermediate Shaft Bearing Shim (.003 in.)	6
	250026	Intermediate Shaft Bearing Shim (.005 in.)	6
	250027	Intermediate Shaft Bearing Shim (.010 in.)	2
36	230081	Cover and Brake Adapter (Swing Gear Box)	1
	230080	Intermediate Shaft Cover (Propel Gear Box)	1
37	400245	Cap Screw	6
38	010028	Brake Drum Hub Oil Seal (Swing Gear Box Only)	1
39	200018	Brake Drum Hub (Swing Gear Box Only)	1
40	400246	Snap Ring (Swing Gear Box Only)	1
41	020184	Brake Drum Hub Plug (Swing Gear Box Only)	1
42	400247	Cap Screw (Swing Gear Box Only)	4
43	400248	Lockwire (Swing Gear Box Only)	1
44	400249	Cap Screw (Swing Gear Box Only)	4
45	400243	Lockwasher (Swing Gear Box Only)	4
46	230071	Brake Assembly (Swing Gear Box Only)	1
47	220034	Intermediate Shaft Bearing Cone - Upper	1
48	220035	Intermediate Shaft Bearing Cup - Upper	1
49	010030	Intermediate Gear Oil Seal	1
	400239	Dowel - Case to Cover	2
	240050	Filler Plug Breather	1
	020186	Filler Plug	1

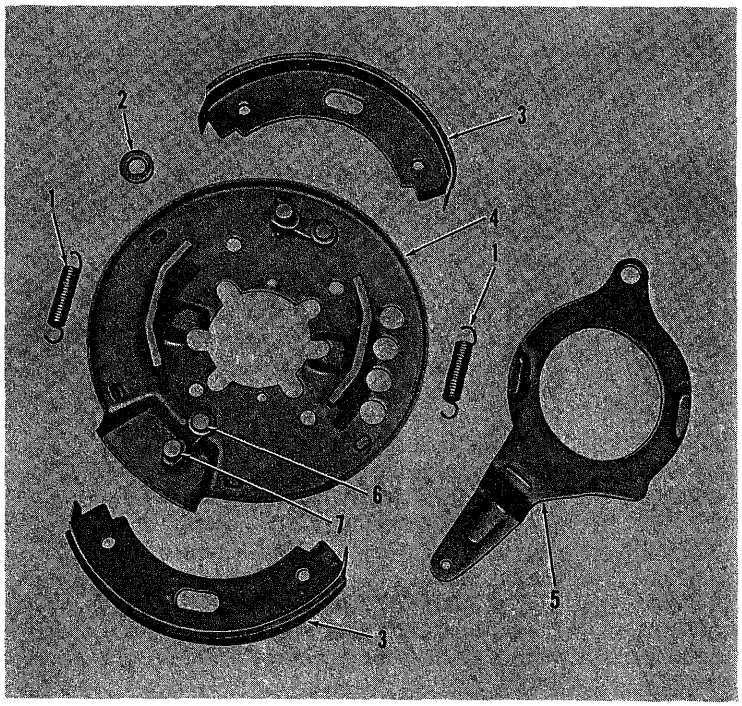

Figure 39. House Brake Assembly

Index Number	Part Number	Description	Quantity
1	230073	Brake Shoe Return Spring	2
2	230072	Roller	1
3	230074	Brake Shoe and Liner Assembly	2
4	230076	Backing Plate Assembly	1
5	230075	Brake Actuating Lever	1
6	230077	Actuating Pawl Rivet	2
7	230078	Actuating Pawl	2

Index Number	Part Number	Description	Quantity
		SWING SYSTEM	
1	400193	O-Ring	1
2	400055	Jam Nut	4
	400056	Lockwasher	4
	400212	Stud	4
3	400188	Cap Screw	2
4	240039	Swing Gear Box	1
5	400185	Stud	2
6	400182	Nut	6
7	400097	Lockwasher	4
8	400184	Stud	2
9	400183	Cotter Pin	2
10	240042	Spacer	1
11	200014	Swing Pinion	1
12	240041	Cap	1
13	400187	Cap Screw	2
14	400191	Lockwire	1
15	400180	Lockwire	18
16	400190	Cap Screw	36

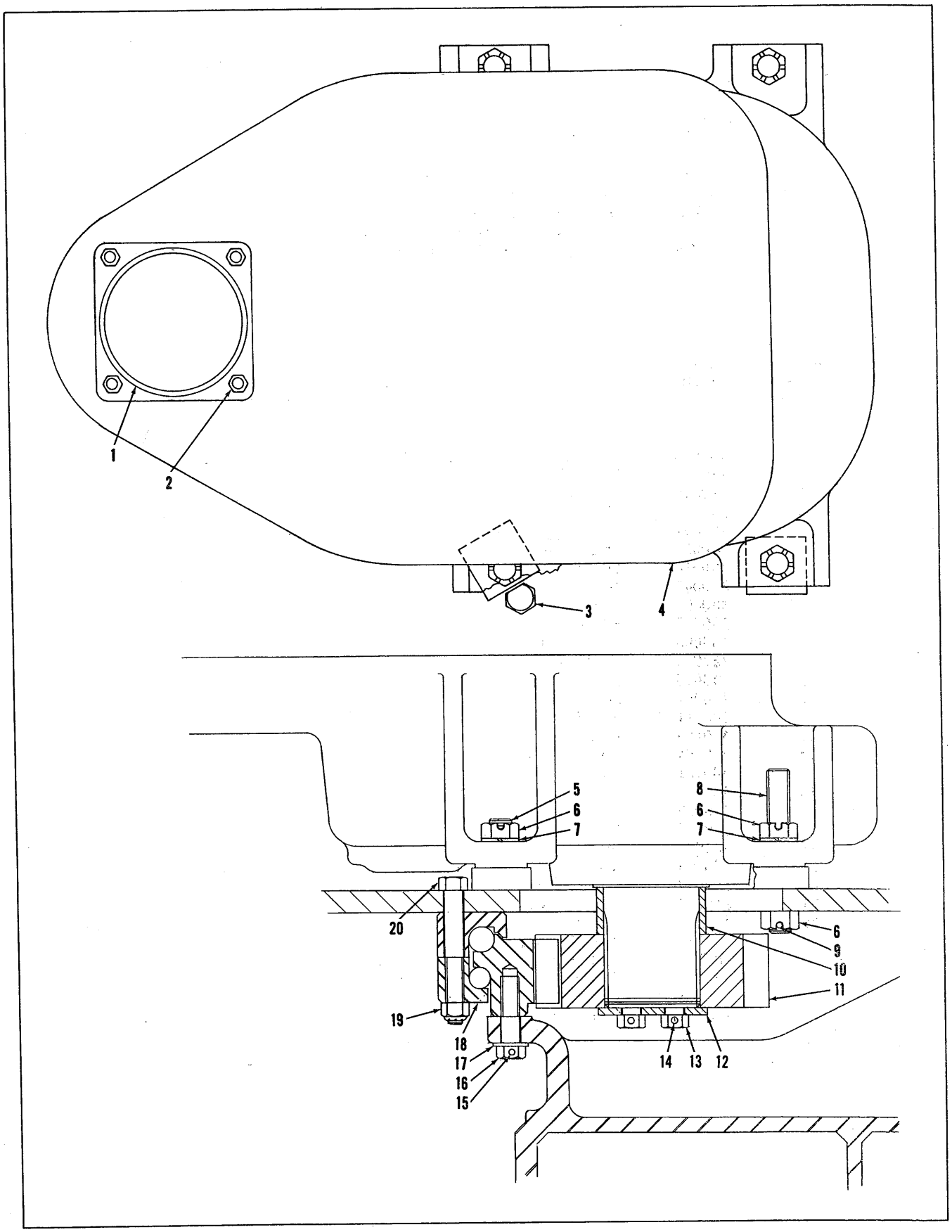

Figure 40. Swing System

Index Number	Part Number	Description	Quantity
		SWING SYSTEM (CONT)	
17	400203	Washer	36
18	220025	Swing Bearing	1
19	400202	Nut	36
20	400189	Cap Screw	34
	250020	Swing Bearing Shim (No. 31 gage)	as reqd
	250019	Swing Bearing Shim (No. 22 gage)	as reqd
	250018	Swing Bearing Shim (No. 16 gage)	as reqd
	250024	Swing Bearing Shim (0.005 in.)	as reqd

Index Number	Part Number	Description	Quantity
		UPPER PROPEL SYSTEM	
1	400015	Grease Fitting	1
2	220016	Thrust Bearing	2
3	210042	Driven Sprocket	1
4	250013	Shim	as reqd
5	400091	Snap Ring	2
6	330058	Shift Yoke	1
	250014	Spacer	1
	210048	Pin	1
7	330057	Shift Yoke	1
	250015	Spacer	1
	400099	Cotter Pin	1
8	220014	Bushing	2
9	220015	Bushing	2
10	210041	Shaft	1
11	200011	Bevel Gear	1
12	400186	Bolt	4
13	400204	Lockwasher	4
14	400181	Nut	4
15	400017	Nut	4
16	400098	Washer	4
17	400195	Bolt	4
18	400067	Bolt	2
19	400069	Nut	2
20	240040	Propel Gear Box	1
21	210059	Drive Sprocket	1
22	400253	Snap Ring	1
	230020	Propel Drive Chain	1
	400212	Stud-Propel Motor Mounting	4
	400055	Nut-Propel Motor Mounting	4
	400056	Lockwasher-Propel Motor Mounting	4
	400193	O-Ring-Propel Motor Mounting	1

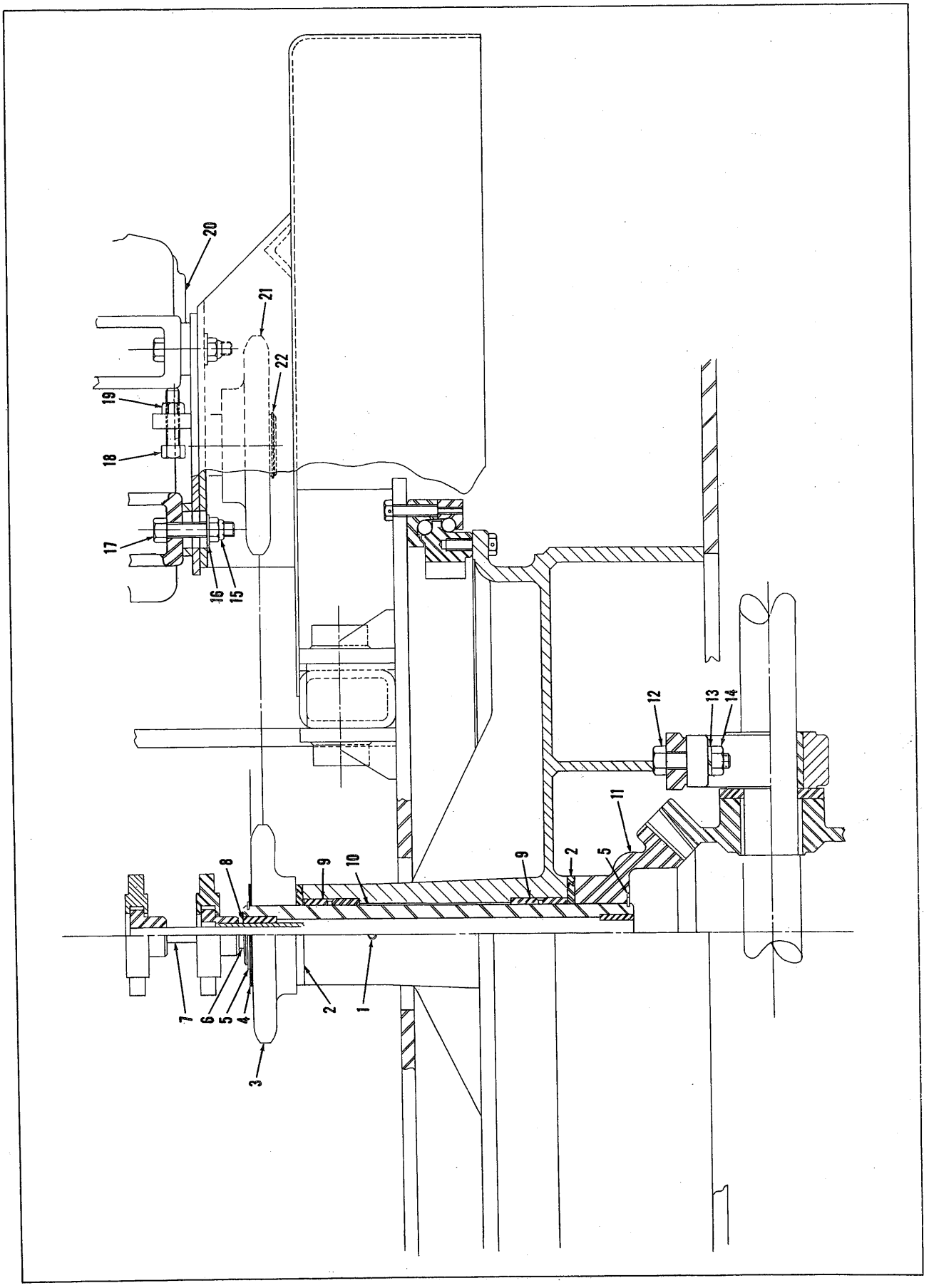

Figure 41. Upper Propel System

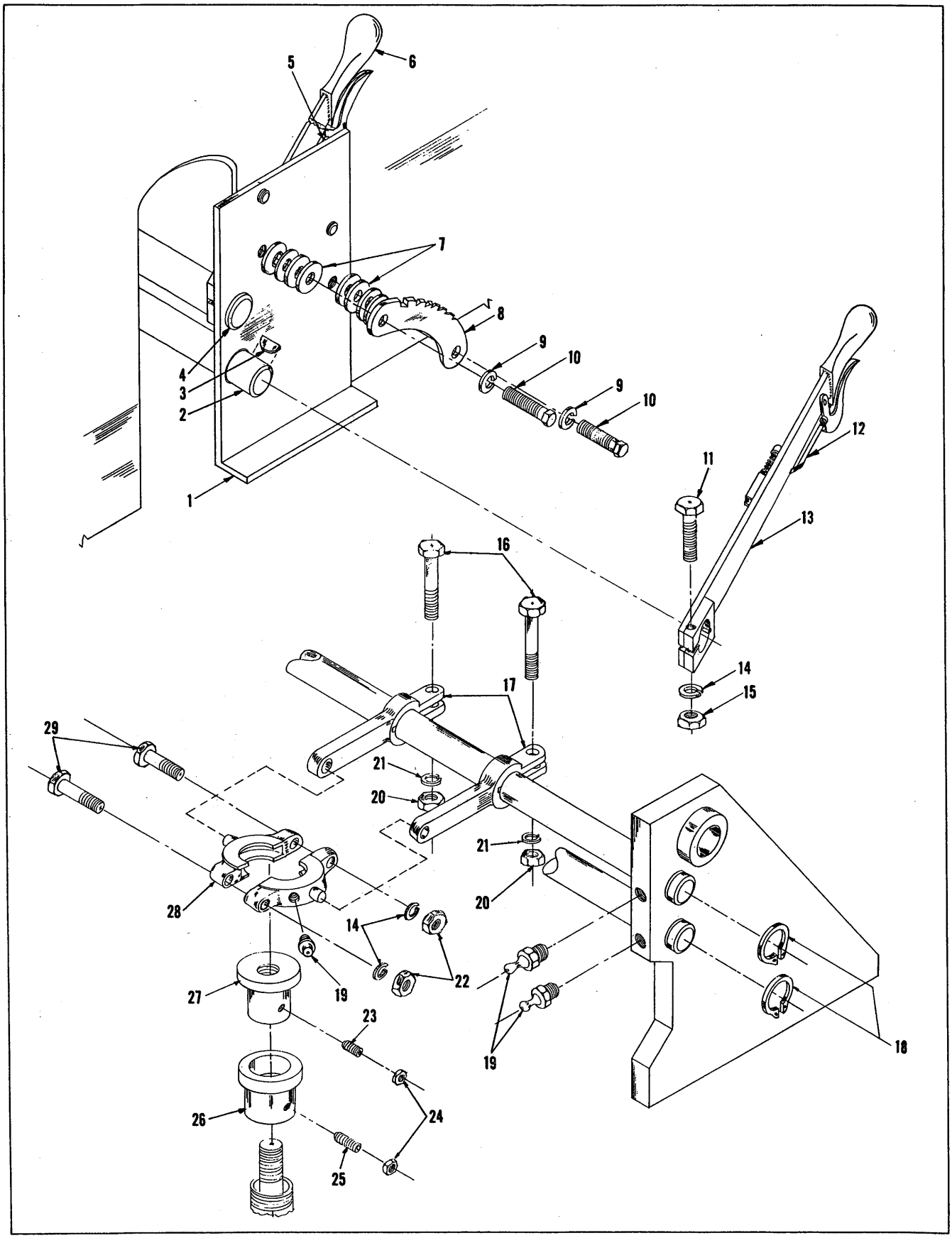

Figure 42. Steering Clutch and Brake Controls

Index Number	Part Number	Description	Quantity
		STEERING CLUTCH AND BRAKE CONTROLS	
1	120087	Mounting Bracket	1
2	210039	Lower Shaft	1
3	400089	Key	6
4	210040	Upper Shaft	1
5	330086	Pawl Rod-Left Hand	1
6	330089	Steering Lever-Left Hand (complete)	1
7	400098	Flat Washer	16
8	210047	Ratchet Plate	2
9	400097	Lockwasher	4
10	400096	Bolt	4
11	400095	Bolt	2
12	330087	Pawl Rod-Right Hand	1
13	330088	Steering Lever-Right Hand (complete)	1
14	400056	Lockwasher	2
15	400055	Nut	2
16	400153	Bolt	2
17	330055	Lever	4
18	400090	Snap Ring	4
19	400015	Grease Fitting	6
20	400227	Jam Nut	2
21	400172	Lockwasher	2
22	400173	Nut	2
23	400132	Setscrew	1
24	400133	Jam Nut	2
25	400131	Setscrew	1
26	210044	Shifter Collar	1
27	210045	Shifter Collar	1
28	210046	Shifter	2
29	400174	Bolt	2

Index Number	Part Number	Description	Quantity
		CRAWLER ASSEMBLY (9 ft. 11 in.)	
1	H-1274	Grease Fitting	17
2	K-3392-A	Outer Guide Hub with Bushing - Left Hand (Use 2 for Right Hand Crawler and 1 for Left Hand)	
3	K-3399-B	Rear Shaft	1
4	K-5954	Bushing	3
5	K-3393	Thrust Washer	5
6	K-37	Key	1
7	K-14-A	Rear Tumbler	1
8	K-3390-A	Inner Guide Hub with Bushing	1
9	K-15-A	Drive Sprocket	1
10	H-3848	Cap Screw	1
	H-3849	Nut	1
	H-1441	Lockwasher	1
11	K-5955	Bushing	2
12	M-635	Crawler Adjusting Bolt	4
13	M-634	Spanner Nut	4
14	K-3396	Spacer	4
15	H-3811	Drive Chain	1
16	M-805	Roller with Bushing	9
17	H-32	Bolt with Nut and Lockwasher	8
18	H-3624	Cap Screw	8
19	K-973	Idler Roller Bracket	4
20	K-972	U-bolt with Nut and Lockwasher	4
21	K-3802	Roller Bearing	14
22	K-66	Load Roller Shaft	7

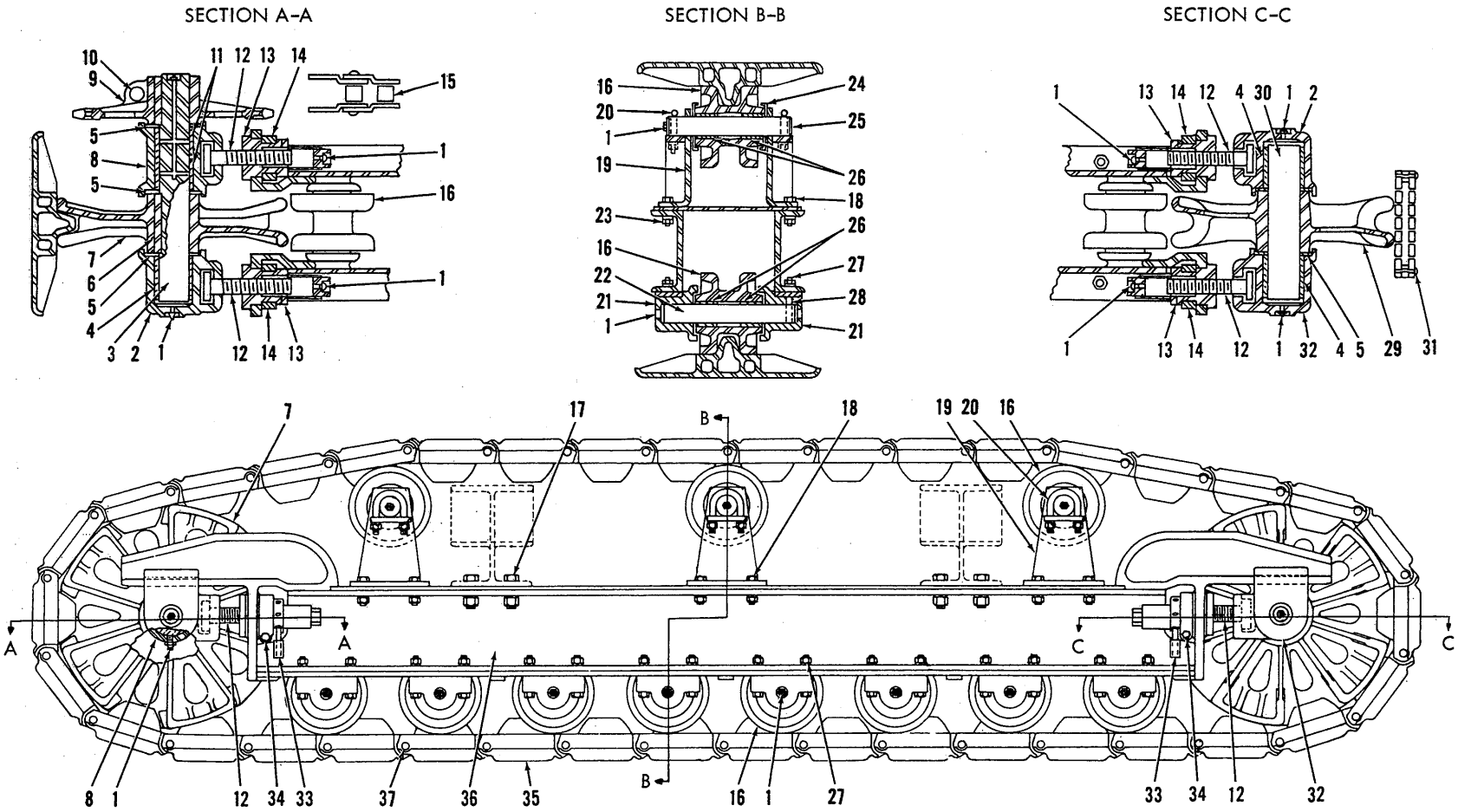

Figure 43. Crawler Assembly

WHEN ORDERING PARTS FOLLOW THE INSTRUCTIONS OUTLINED ON PAGE ii

Index Number	Part Number	Description	Quantity
		CRAWLER ASSEMBLY (9 ft. 11 in.) (CONT)	
23	H-1390	Nut	8
	H-1391	Lockwasher	8
24	K-1012	Shield	4
25	K-1011	Idler Roller Shaft	2
26	K-5641	Roller Bushing	18
27	H-24	Bolt with Nut and Lockwasher	28
28	K-68	Roller Shaft Lockpin	7
29	K-4-A	Front Tumbler	1
30	K-3398-A	Front Shaft	1
31	H-35	Rivet (For 24" Shoe)	34
32	K-3391-A	Outer Guide Hub with Bushing - Right Hand (Use 1 for Right Hand Crawler and 2 for Left Hand)	
33	M-637	Lockpin	4
	H-1312	Cotter Pin	4
34	H-3267	Cap Screw	4
	H-1360	Nut	4
	H-1361	Lockwasher	4
35	K-96	Shoe (24 Inch)	34
	K-95	Shoe (18 Inch)	34
36	K-3401-A	Crawler Frame	1
37	K-97	Pin (For 24 Inch Shoe)	34
	K-17	Pin (For 18 Inch Shoe)	34
		CRAWLER ASSEMBLY (11 ft. 3 in.)	
1	H-1274	Grease Fitting	19
2	K-3392-A	Outer Guide Hub with Bushing - Left Hand (Use 2 for Right Hand Crawler and 1 for Left Hand Crawler)	
3	K-3399-B	Rear Shaft	1
4	K-5954	Bushing	3
5	K-3393	Thrust Washer	5
6	K-37	Key	1
7	K-14-A	Rear Tumbler	1
8	K-3390-A	Inner Guide Hub with Bushing	1
9	K-15-A	Drive Sprocket	1
10	H-3848	Cap Screw	1
	H-3849	Nut	1
	H-1441	Lockwasher	1
11	K-5955	Bushing	2
12	M-635	Crawler Adjusting Bolt	4
13	M-634	Spanner Nut	4
14	K-3396	Spacer	4
15	H-3809	Drive Chain	1
16	K-18	Roller with Bushing	11
17	H-32	Bolt with Nut and Lockwasher	8
18	H-3623	Cap Screw	12
19	K-973	Idler Roller Bracket	6
20	K-972	U-bolt with Nut and Lockwasher	6
21	K-3802	Roller Bearing	16
22	K-66	Load Roller Shaft	8
23	H-1390	Nut	12
	H-1391	Lockwasher	12
24	K-1012	Shield	6
25	K-1011	Idler Roller Shaft	3
26	K-67	Roller Bushing	22
27	H-24	Bolt with Nut and Lockwasher	32
28	K-68	Roller Shaft Lockpin	8
29	K-4-A	Front Tumbler	1
30	K-3398-A	Front Shaft	1
31	H-35	Rivet (For 24 Inch Shoe)	38
32	K-3391-A	Outer Guide Hub with Bushing - Right Hand (Use 1 for Right Hand Crawler and 2 for Left Hand)	

Index Number	Part Number	Description	Quantity
		CRAWLER ASSEMBLY (11 ft. 3 in.) (CONT)	
33	M-637	Lockpin	4
	H-1312	Cotter Pin	4
34	H-3267	Cap Screw	4
	H-1360	Nut	4
	H-1361	Lockwasher	4
35	L-96	Shoe (24 Inch)	38
	K-95	Shoe (18 Inch)	38
36	K-3400-A	Crawler Frame	1
37	K-97	Pin (For 24 Inch Shoe)	38
	K-17	Pin (For 18 Inch Shoe)	38

Index Number	Part Number	Description	Quantity
		PROPELLING CONTROLS IN CARBODY (M-44505.55)	
1	K-638-B	Brake Band Assembly	2
	M-638 and K-6245	Lining and Rivets	2
2	K-623	Toggle Lever	2
3	K-626	Brake Band Pin	2
4	K-6243	Pin	2
5	K-619	Pin	2
6	H-617	Cotter Pin	10
7	K-3722	Pin	2
8	M-1075	Link	2
9	K-3852	Spacer	4
10	M-720	Lever	2
11	H-621	Woodruff Key	4
12	K-642-A	Shaft Support	2
13	H-643	Bolt with Nut and Lockwasher	6
14	H-651	Cap Screw with Lockwasher	2
15	H-1353	Setscrew	5
	H-1556	Jam Nut	5
16	H-3514	Slotted Nut	2
17	K-3723	Key	3
18	K-655	Control Shaft Arm	2
19	K-628	Control Rod	2
20	K-629-A	Spring	2
21	K-645-B	Shaft	1
22	K-647	Shifter Yoke	2
23	K-636	Lever	2
24	K-633-B	Control Shaft	1
25	K-634	Lever	1
26	K-652	Washer	2
27	K-640	Bolt	2
28	K-3759	Pipe Spacer	2
29	K-649	Pipe Spacer	2
30	H-1628	Castle Nut	2
31	H-1305	Cotter Pin	2
32	K-6244	Pin	2
	H-3295	Cotter Pin	2
33	H-1360	Nut	2
	H-1361	Lockwasher	2
	H-3278	Cap Screw	2
34	K-6242	Adjusting Bolt	2
35	400099	Cotter Pin	1
36	250015	Spacer	1
37	210048	Shifter Pin	1
38	250014	Spacer	1
39	330057	Shifter Yoke - Inner	1
40	330058	Shifter Yoke - Outer	1

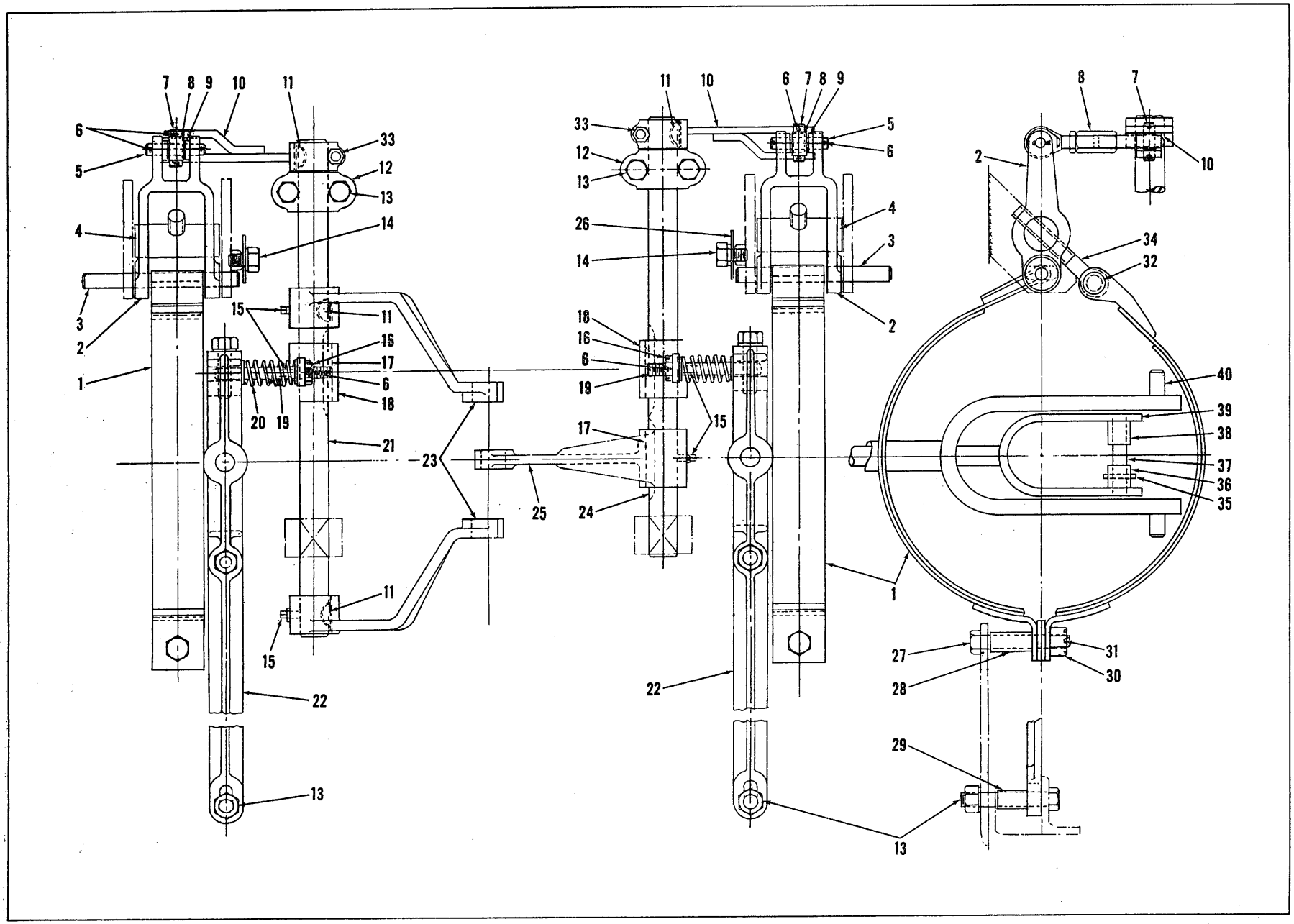

Figure 44. Propelling Controls in Carbody

WHEN ORDERING PARTS FOLLOW THE INSTRUCTIONS OUTLINED ON PAGE ii

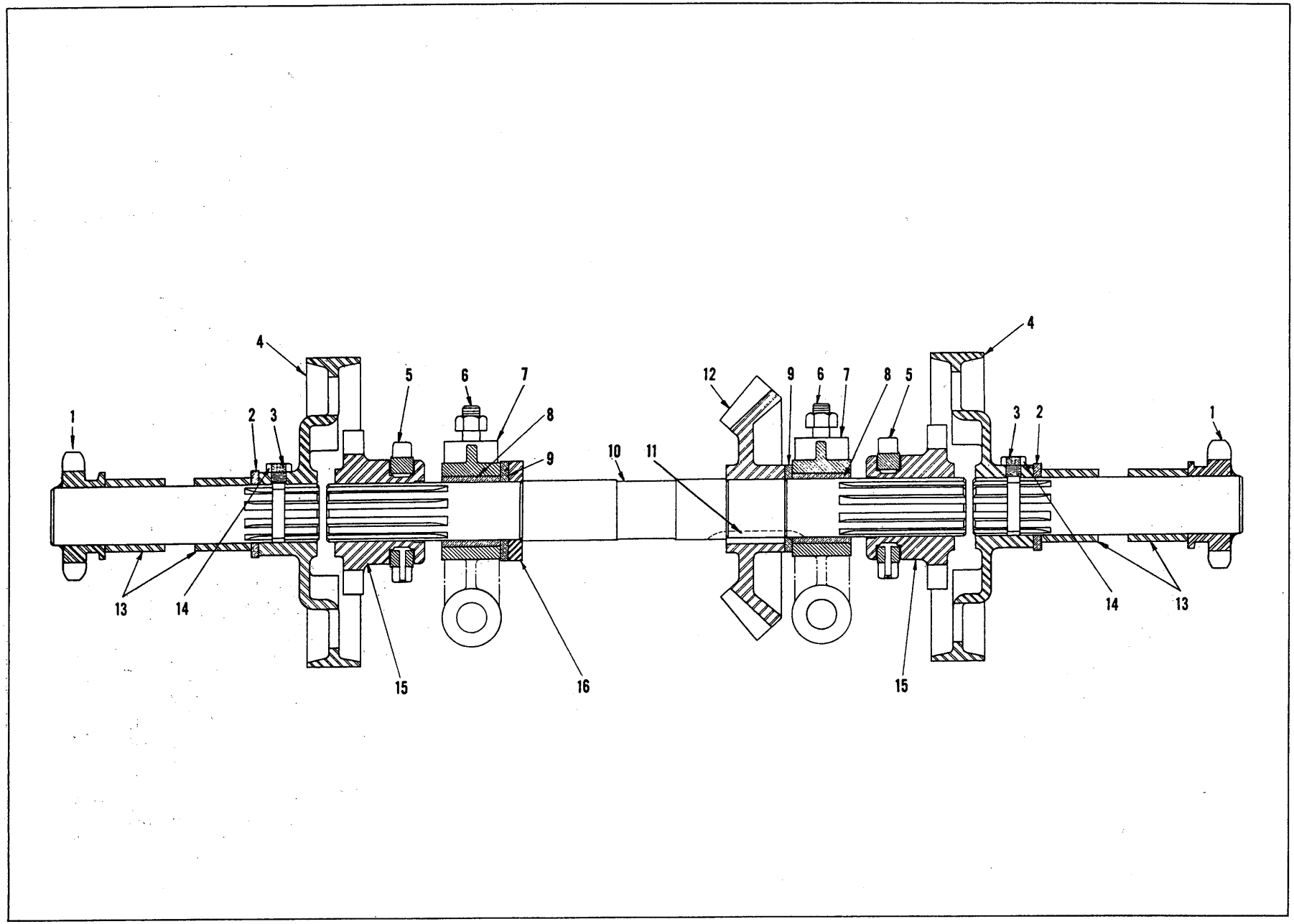

Figure 45. Cross Propel Shaft Assembly

WHEN ORDERING PARTS FOLLOW THE INSTRUCTIONS OUTLINED ON PAGE ii

Index Number	Part Number	Description	Quantity
		CROSS PROPEL SHAFT ASSEMBLY (M-44502.03)	
1	K-82C	Sprocket and Shaft Assembly	2
2	K-3656	Thrust Washer	2
3	K-89	Setscrew	2
4	K-88A	Brake Drum	2
5	K-86	Shifter	2
6	K-3657	Bolt	4
	H-1058	Nut	4
	H-1431	Lockwasher	4
7	K-79	Cross Propel Shaft Bearing with Bushing	2
8	K-81	Bushing	2
9	K-78	Thrust Washer	2
10	K-75A	Cross Propel Shaft with Collar	1
11	K-77	Key	1
12	K-76	Bevel Gear	1
13	K-107	Bushing	4
14	K-92	Jam Nut	2
15	K-90A	Sliding Jaw Clutch	2
16	K-74	Thrust Collar	1

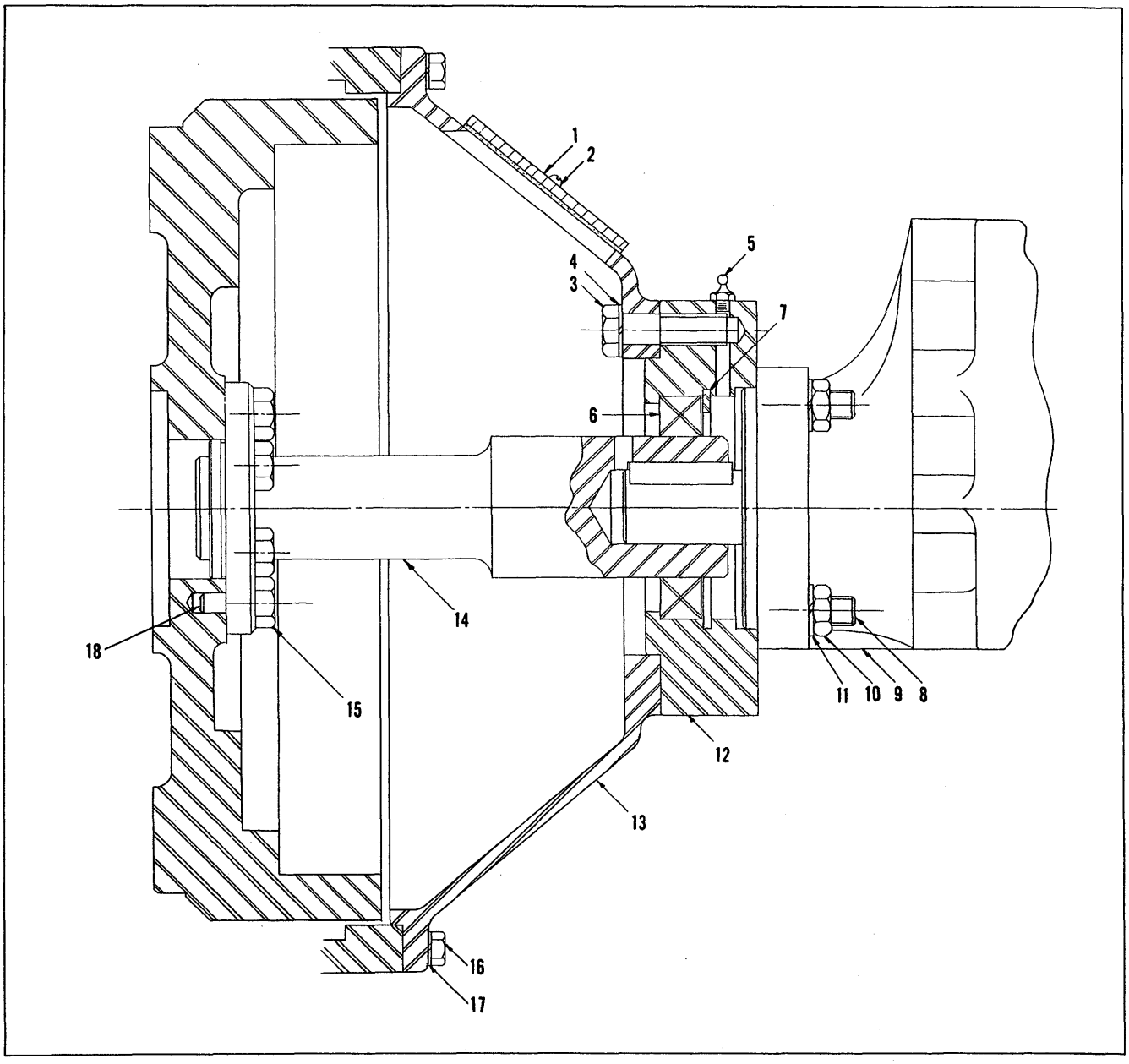

Figure 46. Pump Drive

Index Number	Part Number	Description	Quantity
1	240045	Cover Plate	1
2	400178	Machine Screw	2
3	400192	Cap Screw	4
4	400056	Lockwasher	4
5	400175	Grease Fitting	1
6	220022	Ball Bearing	1
7	400176	Snap Ring	1
8	400212	Stud	4
9	000015	Pump Assembly	1
10	400055	Nut	4
11	400056	Lockwasher	4
12	240044	Pump Mounting Adapter	1

Index Number	Part Number	Description	Quantity
		PUMP DRIVE (CONT)	
13	240048	Clutch Housing (used with GMC engine)	1
	240047	Clutch Housing (used with IHC and Cummins engines)	1
14	210063	Drive Shaft (used with GMC engine)	1
	210065	Drive Shaft (used with IHC engine)	1
	210069	Drive Shaft (used with Cummins engine)	1
15	400109	Cap Screw (used with GMC engine)	6
	400045	Cap Screw (used with IHC engine)	6
	400255	Cap Screw (used with Cummins engine)	6
16	400022	Cap Screw	12
17	400023	Lockwasher	12
18	400111	Dowel Pin (used with IHC engine)	1

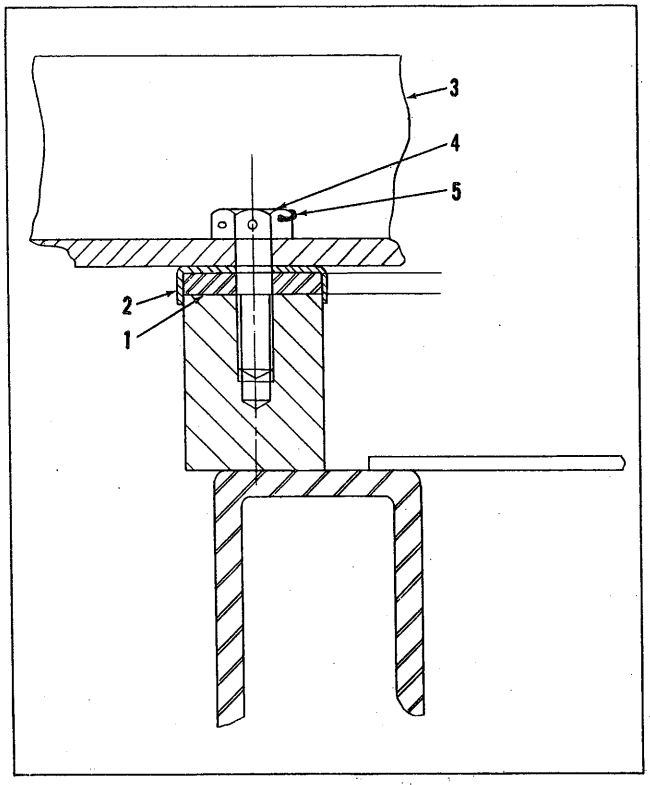

Figure 47. Engine Mount Installation

Index Number	Part Number	Description	Quantity
1	120219	Pad	4
2	120220	Retainer	4
3	120224	Engine Mounting Frame-Front	1
	120225	Engine Mounting Frame-Rear	1
4	400192	Bolt	8
5	400229	Lockwire	4

Index Number	Part Number	Description	Quantity
		ENGINE INSTRUMENTS AND PANEL (NOT ILLUSTRATED)	
	320006	Ammeter	1
	320007	Oil Pressure Gage	1
	320008	Water Temperature Gage	1
	320009	Fuel Level Gage	1
	320010	Starter Switch (for gasoline engine)	1
	320015	Starter Button (for diesel engine)	1
	320004	Water Temperature Sending Unit	1
	320005	Oil Pressure Sending Unit	1
	320016	Hourmeter	1
	320017	Hourmeter Dampener	1
	320000	Panel Assembly	1
		OPERATOR'S CAB (NOT ILLUSTRATED)	
	120125	Cab Mounting Pad	1
	120126	Cab Mounting Pad	2
	120127	Cab Mounting Pad	2
	120058	Front Detachable Glass Panel	1
	120242	Rear Window	1
	120243	Door Window	1
	120244	Top Window	1
	120245	Rear Sliding Window	1
	120056	Door	1
	120246	Door Latch	1
	120247	Window Handles	2
	120248	Front Sliding Window	1
	120036	Seat	1
		MACHINERY HOUSING AND FUEL TANK (NOT ILLUSTRATED)	
	120230	Top Rear Section	1
	120231	Top Left Hand Front Section	1
	120232	Top Right Hand Front Section	1
	120233	Top Access Door	1
	120234	Left Hand End Panel	1
	120235	Rear Left Hand Post	1
	120236	Rear Right Hand Post	1
	120237	Right Hand End Post	1
	120238	Right Hand End Panel	1
	120239	Rear Door	3
	120240	Side Door	1
	120241	Side Door T-Handle	1
	120124	Propel Motor Housing (Complete)	1
	120249	Propel Motor Housing (Body Only)	1
	120250	Propel Motor Housing (Top Only)	1
	050009	Fuel Tank	1